JANUARY 1960

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Electrical South

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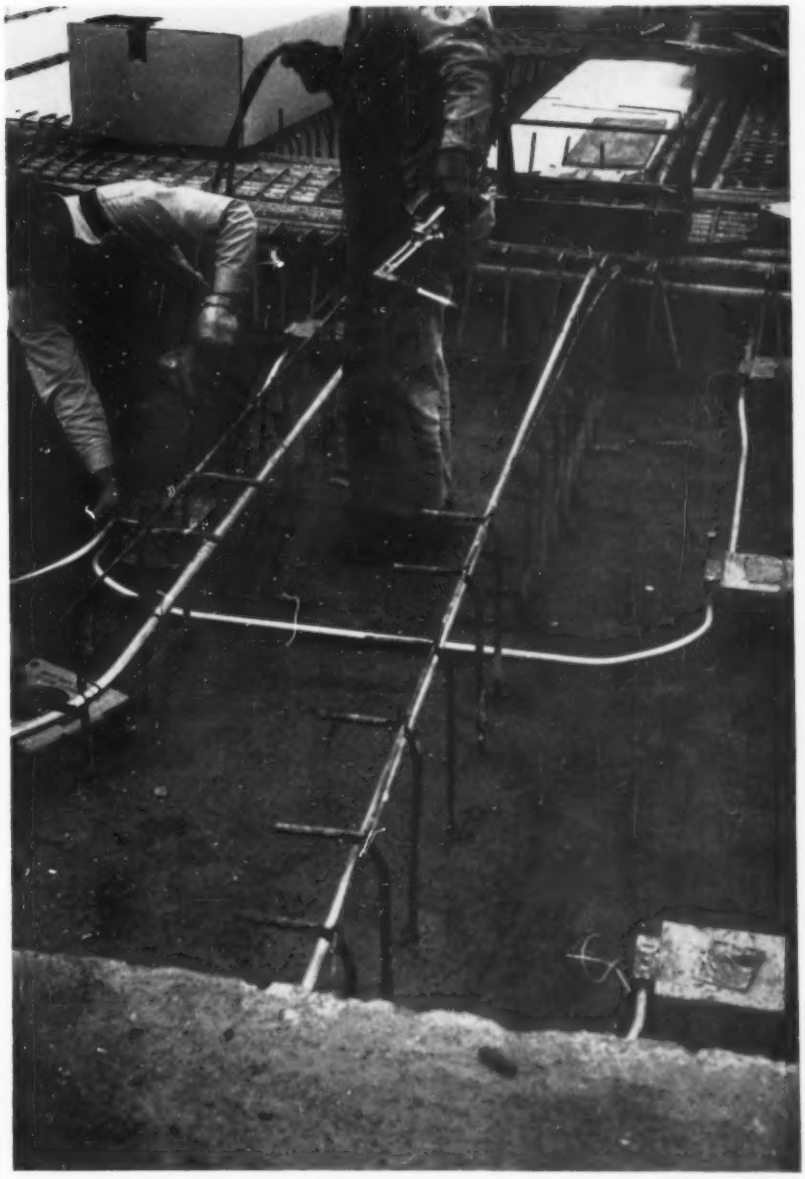

Hollow deck construction complicates electrical work

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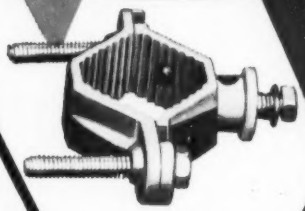

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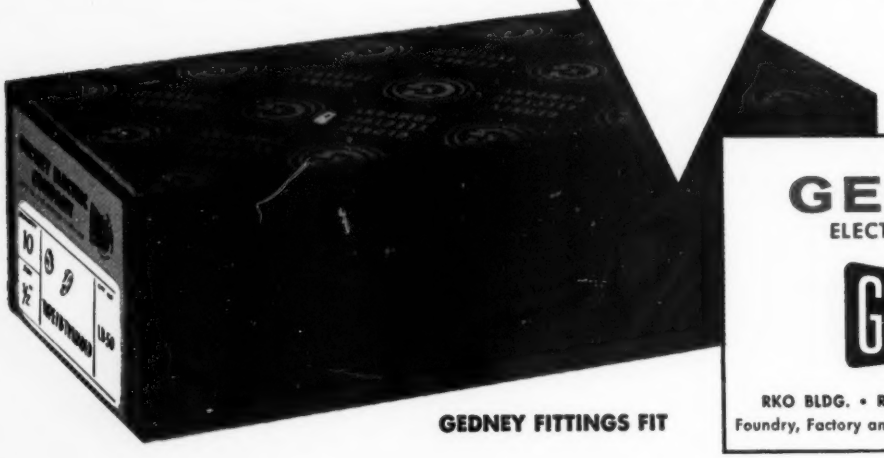

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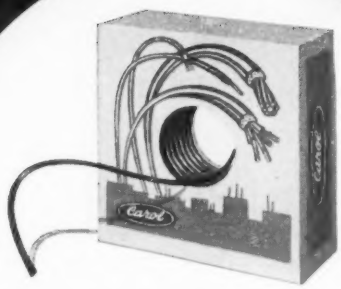

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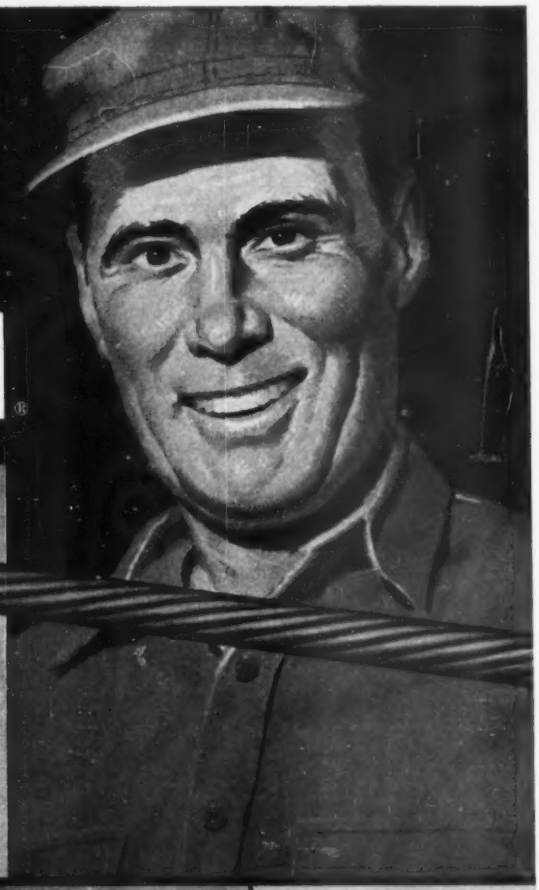

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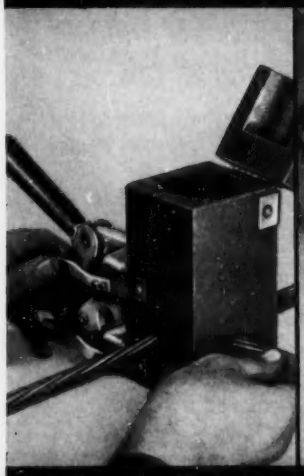

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Economic comment

by J. Whitney Bunting, Ph.D.
Contributing Economics Editor

Economic outlook for 1960

Although it is still too early to accurately reflect upon the progress made by the economy in 1959, the patterns that will carry over and influence the business picture in 1960 are now present. Therefore, at the start of the New Year, it is possible to evaluate some of these patterns and see where they may lead. This is still a bit of "crystal ball gazing" but each year that passes allows for a refinement in prophesying about future economic events.

One of the most important upward pressures in the economic picture for 1960 should be the rate and growth of business and industrial spending for new plants and for the expansion of present facilities. This latter activity would also include the redesigning of production facilities to include economies in operation so important to business and industry in the competitive world of today.

The trend for improved production practices has been increasing at a phenomenal rate and it should be responsible for large scale redesign of many existing plants. It will be noted that one of the basic stumbling blocks of the steel strike was the emphasis placed by management on the need for such revision within the steel industry plus the right of management to take such action in the best interests of the business operation.

A typical business decision of today is whether or not to build new facilities for the production of goods or to refurbish with new layouts the existing manufacturing plants. In either case, the costs incidental to the final decision should do much to give a strong upward lift to the economy. In the past many companies were in the position where the decision had no immediacy and could be delayed if unfavorable business conditions developed. Now, it is almost a competitive necessity in many cases and any slight business recession might make the cost-saving benefits imperative for business survival. About the only dark cloud hovering over this factor would be the development of a full-blown depression, considered most unlikely at this time.

Dr. Bunting is a well-known economist and educator having special knowledge of the South.

Impact of government

Many economic forecasters have raised questions about the possible change in the quantity of federal government spending, particularly if there might be visible signs of a relaxation of the so-called "cold war." This question has been pretty well answered for the probable federal defense outlay may be in excess of similar expenditures in 1958 and 1959. The President and the Secretary of Defense have both cautioned strongly against any relaxation of our national defense efforts until such a time as the Soviet government might provide effective guarantees for world peace.

Mr. Eisenhower's December tour provided world wide assurance that this nation would not sacrifice its own military strength or that of its allies until the danger of conflict was completely passed. This alone is definite assurance of consistently high defense expenditures.

In addition to this fact, however, there is the definite knowledge that the United States has lagged behind the Russians in regard to missile development and space exploration. Since both of these projects are closely related and require huge research and development outlays, it is inconsistent to believe that national expenditures in these areas will be reduced in the foreseeable future.

Public sentiment is so solidly behind the need for parity with (if not actual leadership over) the Russian space program that there is little demand for a reappraisal of such costs and their possible reduction. Leading scientific observers claim that this nation is two to three years behind in the space race at present so that this situation may be expected to bulwark the economy for several years into the future.

The inventory pattern

A third, and extremely important, economic factor for 1960 is the problem of business inventories. The inventories of both finished goods and materials for manufacture have been seriously depleted in 1958 and 1959. In the first place, the recession of 1958 caused many business firms to reduce inventory stocks to very low levels. Then, as production was resumed in 1959 and normal inventory patterns were re-established, the protracted steel strike occurred thus once again reducing inventories.

There is little indication, at this writing, that the steel troubles are really over, and this situation may continue to confuse this factor. However, there is little doubt but that wherever and whenever possible inventories must be rebuilt at a fast and furious pace. With a settlement of the steel strike this could be the most significant item in the whole picture of economic activity in 1960.

Word of caution

It has been stated previously in this column that the greatest imponderable for next year is the problem of labor unrest. This is still a very big factor and could wreak havoc in all forecasts. There are many important industrial labor contracts that must be renegotiated, particularly during the last half of the year. It could well happen that if several of these caused long and costly strikes, the whole picture of strong economic advance might be changed. If such should happen, it would amply prove the statement that "few gain from a strike but the public always loses."

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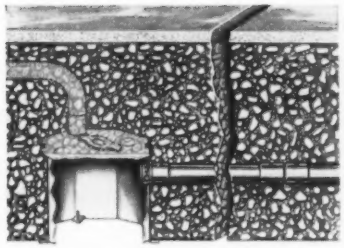

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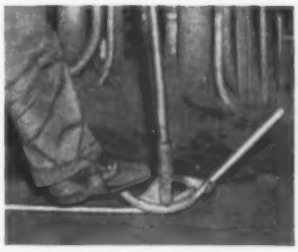

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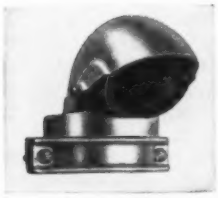

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Washington report

By Jack James

Digest of Washington news of special interest to the electrical industry

Record construction foreseen for 1960

New construction costs will zoom to $55.3 billion in 1960, experts at the U. S. Department of Commerce say. The figure is two per cent above the record $54 billion estimated for 1959.

The rise in spending, however, does not mean more work. "Because of rising construction costs, the total dollar outlays will represent the same physical volume of work as in 1959," the Department says.

The Department expects that new housing will decline 6 per cent. This will be due largely to the tight supply of mortgage funds as 1959 closes.

Work on industrial projects which dropped 18 per cent in 1959 will rocket up 26 per cent in 1960, the Department predicts. Commercial work will jump 16 per cent.

There will be increases in spending on public projects. School outlays will probably rise three per cent. Value of administrative and service buildings may soar 19 per cent.

While the Department of Commerce was making its predictions about construction other economists were predicting that 1960 would be a good business year, barring a major steel or rail strike.

Business men rebuilding inventories cut by the steel strike will push the economy into a mild boom in the first half of 1960, the economists said. They warned that interest rates on banks loans would also rise because of increased demand for inventory loans.

Further increases in electricians' pay

Electrical contractors raised pay for union journeymen electricians an average of 14.2 cents an hour in the 12-month period ending Oct. 1, the Bureau of Labor Statistics in the U. S. Department of Labor reports.

The Bureau surveyed rates in 100 cities in the United States and found that the average wage was $3.85 an hour for union electricians. The rates ranged from $2.62½ at Raleigh, N. C., to $4.60 at Pittsburgh, Pa.

Here are the rates in 32 Southern cities included in the survey: Atlanta, $3.70; Baltimore, $3.75; Birmingham, $3.65; Charleston, S. C. $3.10; Charleston, W. Va., $3.77½; Charlotte, N. C., $2.90; Chattanooga, Tenn., $3.50; Columbia, S. C., $3; Dallas, $3.50; El Paso, $3.55; Houston, $3.80; Jackson, Miss., $3.30; also,

Jacksonville, Fla., $3.65; Knoxville, Tenn., $3.40; Louisville, Ky., $3.75; Memphis, Tenn., $3.60; Miami, Fla., $3.65; Mobile, Ala., $3.65; Nashville, Tenn., $3.32½; New Orleans, $3.60; Norfolk, $3.42½; Oklahoma City, $3.62½; Raleigh, N. C., $2.62½; Richmond, Va., $3.27½; St. Louis, $4.11; San Antonio, Texas, $3.50; Savannah, Ga., $3.45; Shreveport, La., $3.60; Tampa, Fla., $3.50; Tulsa, Okla., $3.76; Washington, D. C., $4.20; and Wilmington, Del., $3.97½.

These scales are the minimum hourly rates. They exclude vacations, holiday, health and welfare, pension, overtime, dangerous work, and other extra rates.

Convention delegates watch tax deductions

Come income tax time, electrical contractors who attended conventions as delegates in 1959 might find that the Bureau of Internal Revenue will not allow many deductions.

The Bureau has come out with a series of changes in its regulations. At least two of the changes will affect many electrical contractors.

The Bureau says that if you go to a convention as a delegate, for income tax purposes you cannot deduct the expenses. That is true unless you can show that your primary reason for attending was to improve your own business and that being a delegate was only incidental.

If you spent half the time as a delegate and half the time promoting your own business, then the Bureau will probably allow you to deduct half your expenses for income tax purposes. In other words, you can figure out how much time you spent as a delegate, how much time as a business man, and prorate expenses.

The Bureau of Internal Revenue also says that it will not allow you to deduct dues paid to an association which does a substantial amount of lobbying on the city, county, state, or federal level. The trouble is that the Bureau has not yet said what it considers "substantial."

For employer associations the new regulation poses serious problems. The associations point out that even support of a school bond issue could be considered lobbying and deprive members of tax deductions.

Withholding tax on subsistence pay

The Bureau of Internal Revenue says that employers must start withholding tax on amounts paid to cover daily transportation, meals, lodging, and the like for employees who work a year or more at construction projects in remote areas.

The Bureau previously held that such amounts paid employees at remote projects for a temporary period are not wages for employment tax purposes, including income tax withholding.

Now, in order to relieve hardship after returns are questioned and employees must shell out sizeable amounts to Uncle Sam, the Bureau decides that tax shall be withheld on such payments:

". . . (1) when an employee has worked for a substantially continuous period of one year in any particular project area; or (2) if, at the time an employee is hired, it is contemplated that his assignment or series of assignments in any particular project area for the employer may continue for more than one year; or (3) if it becomes apparent at any time that an em-

(Continued on page 100)

SIMPLE...

SAFE...

LIQUID-TIGHT...

APPLETON®

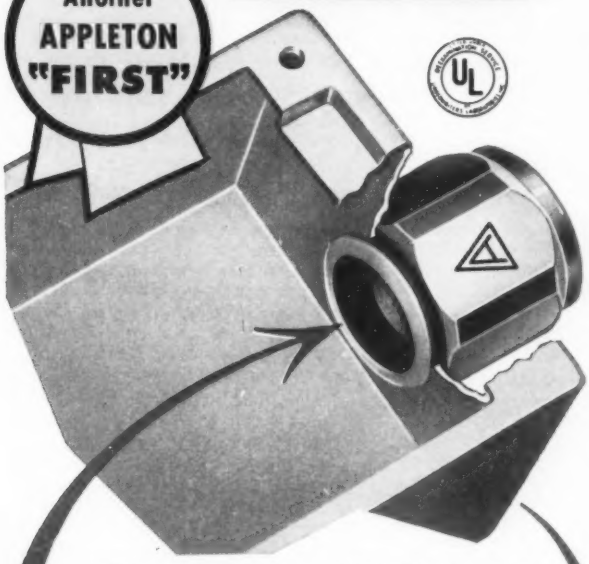
UNI-SEAL

Rigid-Conduit HUB

Patent Pending

DUST-PROOF!

Another APPLETON "FIRST"



Eliminates Welding!

Up to now when a tight box-hub seal was wanted, threaded hubs were attached by the costly, complicated, time-consuming method of welding. This gave a rough, frequently off-center result. Today, with APPLETON Uni-Seal Hubs, you get a liquid-tight connection without welding . . . simply, easily and always uniformly centered. Application requires only a single wrench! Always a perfect "cold-weld" seal! And the wedge adapter is almost flush with inside box wall for maximum wiring room.

Unparalleled ease of installation and positive liquid-tight, dust-proof protection are built right into this new APPLETON *Uni-Seal Hub.* An exclusive wedge adapter pulls up tight in the knock-out hole to give a lasting metal-to-metal "cold-weld" seal with full assurance of a perfect ground. Lasting resistance to vibration! Maximum wiring room because wedge adapter tightens down almost flush inside box! Insulated throat to protect wiring! Single wrench installation! So . . . for cost-cutting wiring installation, specify APPLETON UNI-SEAL Rigid Conduit Hub!

HOW IT WORKS...

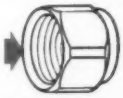
Wedge adapter with threaded shank is inserted through junction box hole. Threaded hub with special locking edge on body is screwed down on adapter threads until box metal is firmly gripped between adapter wedge and locking edge. A pull or two on the hub with a single wrench locks the hub in position permanently with a perfect metal-to-metal "cold-weld" seal that does not vibrate loose. Rigid conduit is then screwed into hub.

Also available in a Union type.
Pat. Pending

These 4 Exclusive Benefits are YOURS... with APPLETON

New Insulated Throat!

An insulator insert provides complete protection against damage to wires from metal edges. No reduction in inside throat diameter. The complete answer where vibration is a problem!



New Locking Edge on Body!

Puts continuous pressure on wedge adapter! Bites into outer box wall to eliminate loosening through vibration! No lock nut needed! Assures positive ground!

New Wedge Adapter!

Note adapter surface angle . . . how design permits it to tighten almost flush with inner box wall. Maintains positive ground and a constant, liquid-tight, "cold-weld" seal when pulled down.

Increased Wiring Room!

Interior view of wiring box with installed UNI-SEAL Rigid Conduit Hub showing how wedge adapter tightens almost flush to provide maximum wiring room. No weld! No wrench required inside box!

Sold Through Franchised Distributors Only

APPLETON ELECTRIC COMPANY
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Also Manufacturers of:

Industrial Lighting Equipment

Malleable Iron Unilets

"Eagle Claw" Switch Boxes

Automatic Reelites

APPLETON ELECTRIC PRODUCTS®

CATALOGS and BULLETINS

Available Free to Readers of Electrical South upon Request

FITTINGS AND FIXTURES—Information relative to explosion-proof fittings, fixtures, plugs and recptacles, and accessories is available in a 50-page book illustrating the complete line of these products manufactured by Killark Electric Mfg. Co., Easton and Vandeventer Ave., St. Louis 13, Mo.

Write in No. A101 on card, Pg. 17

ELECTRICAL BOXES—Steel City Electric Co., 1207 Columbus Ave., Pittsburgh 33, Pa., offers a catalog of their complete line.

Write in No. A102 on card, Pg. 17

STEEL WIRE—Technical information on Alumoweld, a newly developed aluminum-covered steel wire and strand, is contained in a 12-page catalog, just issued by the Wire and Cable Division of Copperweld Steel Co., 322 Frick Building Pittsburgh 19, Pa. Illustrated and documented with engineering data, the colorful catalog provides a complete working knowledge of this new material—its properties, advantages, applications and construction practices.

Write in No. A103 on card, Pg. 17

ELECTRICAL FITTINGS — A 40-page illustrated catalog and price list on the Gedney line. Shown and listed are conduit, threaded entrance, SEC, EMT and ground fittings and box connectors for both armored and nonmetallic cables. Copies are available from Gedney Electric Co., RKO Bldg., Radio City, New York 20, N. Y.

Write in No. A104 on card, Pg. 17

CONSTRUCTION ANCHORS—"Anchoring for Power and Communication Lines/" a completely illustrated manual on improving line construction with better anchoring, has been published by the Advertising Dept., the A. B. Chance Co., Centralia, Mo. The 25-page booklet shows how to install the right anchor at the right place in the right way.

Write in No. A105 on card, Pg. 17

SERVICE PANELS — Information on protective electric control centers for homes, apartment buildings, service stations, and industrial applications is contained in Bulletin PM-385, "BullDog Pushmatic Electric-Centers," issued by BullDog Electric Products Co., 7610 Jos Campau, Detroit, Mich.

Write in No. A106 on card, Pg. 17

ELECTRICAL FITTINGS — Blackhawk Industries, Dubuque, Iowa, offers a complete catalog of electrical conduit and cable fittings. Also a special publication giving detail drawings and instructions for installing service entrance masts on low or ranch type buildings.

Write in No. A107 on card, Pg. 17

WIRE PULLING LUBRICANT — Illustrated six-page folder showing the advantages of an improved Y-Er Eas wire pulling lubricant is available from Electro Compound Co., 4145 W. 150th St., Cleveland 11, Ohio.

Write in No. A108 on card, Pg. 17

GENERAL CATALOG — General catalog of Royal Electric Corporation, Pawtucket, R. I. covering flexible, service and lamp cords, cord sets, extensions, trouble lights, wiring devices and fuses is available to wholesalers. Dealers catalogs may be secured from Royal distributors.

Write in No. A109 on card, Pg. 17

CARBON PRODUCTS—A 28-page catalog on Motor and Generator Brushes and carbon products telling how to order brushes, grade recommendations, characteristics, and description of brush grades, is available from the Helwig Co., 2536 North 30th St., Milwaukee, Wis.

Write in No. A110 on card, Pg. 17

**POWER BENDER — The lightweight hydraulic power bender #884, manufactured by Greenlee Tool Co., of Rockford, Ill., is described in a new bulletin issued by the company.

Write in No. A111 on card, Pg. 17

ELECTRICAL EQUIPMENT—The Wadsworth Electric Mfg. Co., Inc., Covington, Ky., has issued a new catalog 58' Guide, containing data on their line of Safety Switches, Service Equipment, Distribution Panels, "E-Z-RED" Circuit Breakers, interchangeable and non-interchangeable, also wiring troughs.

Write in No. A113 on card, Pg. 17

COMPRESSION CONNECTORS — New and fully illustrated Bulletin 13 offered by the James R. Kearney Corp., 4236 Clayton Ave., St. Louis 10, Mo., shows their complete line of Squeezon compression fittings. They make all overhead distribution connections from line wire to ground rod on aluminum, ACSR, copper, or combinations of them. Application and installation data are given for tap connectors of several types; service entrance, splicing, jumper and repair sleeves; terminals, stirrups and ground fittings. Mechanical and hydraulic installing tools for both dead and hot line work are listed.

Write in No. A114 on card, Pg. 17

SELECTING FUSES — A 12-page descriptive handbook "Fuseology tells how to get safest most dependable, trouble-free electrical protection from fuses. Contains useful information on selecting right size and type of fuses —how to stop needless blows—avoiding poor contact and other troubles. Issued by Bussmann Mfg. Co., University at Jefferson, St. Louis 7, Mo.

Write in No. A115 on card, Pg. 17

LIGHTING FIXTURE DATA—The Perfeclite Co., 1457 East 40th Street, Cleveland 3, Ohio, makes available the following literature: (1) Data Folder 54-B—4 pages of engineering information, prices and specifications on Plastic Indirect Concentric Ring Luminaires. (2 Data Folder EX-57—10 pages of information on Exit Units for all building locations. Complete Engineering data and prices given. (3) Data Folder 56-A—Information on Ceiling Pan Fixtures and Vapor Proof Prismatic Exterior Fixtures. (4) Data Folder 58-A on Concrete Mounting Boxes for recessed incandescent units. (5) Data Folder 58-B on Fluorescent Exit Units. (6) Data Folder 58-C on Phosphorescent Exit Units. (7) Data Folder 57-A on extra shallow recessed units and square ceiling pans. (8) Catalog 956—60 pages plus 12-page supplement, complete with descriptions and engineering information. (9 Data Sheet 57-D—a two-page description of square ceiling pan units and exterior conduit mounted-pan-type units.

Write in No. A117 on card, Pg. 17

ELECTRICAL FITTINGS—Concise 36-page catalog illustrates and describes a complete line of electrical fittings, cable racks and wiring specialties. The catalog contains many detail drawings, clear-cut photographic illustrations of mast fittings, cable connectors, traps, hangers and ground clamps in a wide variety of types and sizes. For your free copy, write The M. & W. Electric Mfg. Co., East Palestine, Ohio.

Write in No. A120 on card, Pg. 17

INFORMATION CENTER

BOOKLETS • NEW PRODUCTS • ADVERTISEMENTS

Help yourself to free literature and more details on any product mentioned in this issue.

Instead of writing a dozen different manufacturers for free literature and more information on products, tools, or services, just insert on the cards below the appropriate key numbers of the items in which you are interested. These cards may be used to get information on products mentioned in the following departments (see Contents Page for page number):

Catalogs and Bulletins — New Electrical Products
New Utility Equipment — Manufacturers' Literature

Be sure to print or write legibly your name and address—drop it in the nearest mail box and

ES pays the postage!

JANUARY, 196

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BUSINESS REPLY CARD

FIRST CLASS PERMIT NO. 882, SEC. 34.9, P. L. & R., ATLANTA, GA.

Electrical South

806 PEACHTREE ST., N. E.

ATLANTA 8, GEORGIA

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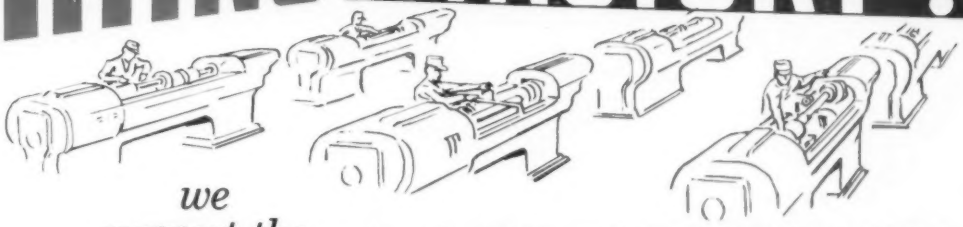
Electrical South

806 PEACHTREE ST., N. E.

ATLANTA 8, GEORGIA

LIGHTING A FACTORY?



we suggest the **"L & P" FACTORY LITE**

U. L. Approved

APPLICATION:

Specifically designed for direct or general illumination in factory, storage or warehouse area.

TYPE:

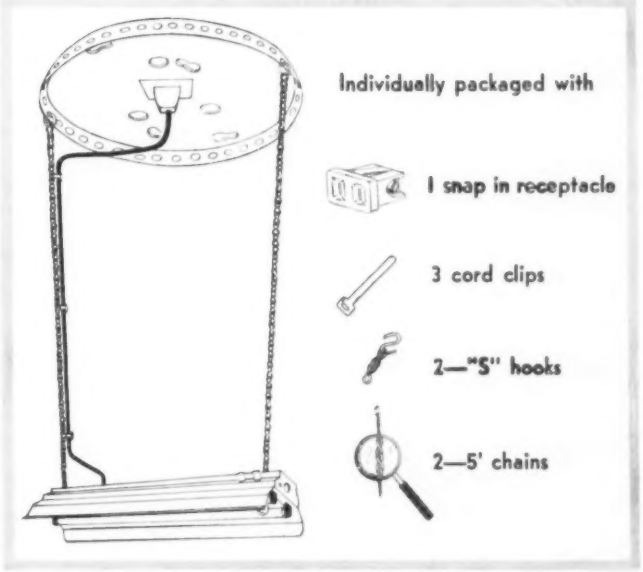
An economical fluorescent industrial fixture made with the same high quality material of all L & P fixtures—Two lamp, forty watt only.

CONSTRUCTION:

Designed for easy installation. Reflector snaps in or out for wiring and maintenance without disturbing sockets. Ample knockouts. Designed for stem or chain hanging, heavy gauge steel construction. Socket plate snaps in place with no tools. Removable end piece forms continuous row connector. L & P quality, high reflectance finish.

MOUNTING:

Fixture may be surface or pendant mounted—Designed for continuous row or single unit installation.



- Designed for quick mounting with 2 screws
- Hooks are positively located for maximum safety
- Any number up to 36 chains can be used
- Ample knockouts for use with all standard outlet boxes
- Made from .0595" thick steel
- Corrosion treated and finish coated
- Three circular knockouts for switch mounting

Cat. Series FL

For catalog and price sheets, write or phone today to

LIGHT & POWER UTILITIES CORP.

1035 FIRESTONE BLVD. • MEMPHIS, TENNESSEE

NEED WATERPROOF LIGHTING?

. . . we suggest the

Cat. No. 50

L & P DELTA SHOWER LITE

All the quality, tested performance and economy that have earned Light & Power an enviable reputation in fluorescent fixtures are also available in the complete L & P Delta line of incandescent fixtures.

Whenever you need water-proof lighting for any purpose, check these features of the Delta Shower Lite before you select your incandescent fixtures!

CONSTRUCTION:

Spun aluminum face plate with vapor resisting gasket. Flashed opal lens designed for wide spread light distribution. Proper ventilation—Moisture proof.

ELECTRICAL:

660W - 250V. Heavy duty porcelain socket. Wired for 110V - 60 cycle. UL approved. AFL-IBEW fabricated.

MOUNTING:

Recessed. Supplied with plaster ring and all necessary mounting parts.

FINISH:

Brushed Satin face plate—sprayed with heat resisting lacquer and infra-red baked at 375° F. to insure protective coating.

For catalog and price sheets, write or phone today to

DELTA delta incandescent division

LIGHT & POWER UTILITIES CORP.

1035 FIRESTONE BLVD. • MEMPHIS, TENN.

Distributed by Wholesale Dealers Only

There's an

L&P

Representative Near YOU!

For further information and prices on L & P fluorescent fixtures—standard or "custom-made"—check the following list, and phone or write the L & P representative nearest you:

N. B. Nichols
2509 Bishop
Little Rock, Arkansas

Craig-Owen
306 E. 11th St.
Chattanooga, Tenn.

C. V. Hammon
845 Southwest 52nd St.
Oklahoma City, Oklahoma

Irving Milow
415 Clover St.
Rochester, New York

W. J. Milner
3627 Peachtree Rd., N. E.
Atlanta, Georgia

J. Louis Weyhing
1914 Rutherford Ave.
Louisville, Kentucky

Irvin Spero
4142 Stillmore Rd.
South Euclid, Ohio

Howard E. Johnson
2976 Randy Lane
Dallas, Texas

Arthur H. Swartz
5003 Kelso St.
Houston, Texas

J. F. Hisserich
2001 Big Bend Ave.
St. Louis, Missouri

Joe E. Pearce & Associates
3845 N. Irvington St.
Indianapolis, Indiana

Associated Manufacturers Agents
900 Carondelet St.
New Orleans, Louisiana

Bill Sylvester
2144 Welton St.
Denver, Colorado

Newell L. Willard
3625 Ivy
Denver, Colorado

J. A. Goode Company
15842 James Couzens Ave.
Detroit 38, Michigan

Gerald Preacher
1225 Pickens
Columbia, South Carolina

Light & Power Utilities Corp.
1035 Firestone Blvd.
Memphis, Tennessee

CATALOGS and BULLETINS

Available Free to Readers of Electrical South upon Request

CABLE CONNECTORS — Tomic Sales and Engineering Co., 20000 Sherwood Ave., Detroit 34, Mich., now have available catalog sheets containing data on the complete line of their connectors, couplings, and cable connectors.

Write in No. A121 on card, Pg. 17

WIRING DEVICES — A complete new catalog of wiring devices is now available from Bell Electric Co., 5735 S. Claremont Ave., Chicago 36, Ill. The line includes a wide range of weatherproof receptacles and switches, portable garden light, wall plates, and specialty items.

Write in No. A122 on card, Pg. 17

PLUG-IN REELITE — Complete details about Appleton's lightweight, portable automatic Reelites are given in an attractive 4-page catalog insert. These devices find application in a wide range of occupancies: garages, loading docks, garment industry, construction crews, warehouses, machine shops, etc. Write to Appleton Electric Co., 1701 Wellington Ave., Chicago 13, Ill.

Write in No. A124 on card, Pg. 17

WIRING PRODUCTS — Various features of J&S Despard interchangeable wiring devices and detailed information concerning this line are offered in a brochure released by Pass & Seymour, Inc., Dept ES, Syracuse 9, N. Y. Included are such features as Camstrap for quick, easy installation, three-wire grounding, and pressure terminal devices.

Write in No. A125 on card, Pg. 17

FLUORESCENT BALLASTS—Advance Transformer Co., 2950 N. Western Ave., Chicago 18, Ill., has recently completed the compilation and printing of a 20-page catalog on fluorescent ballasts and their use. Included are data sheets on available advance ballasts and a comprehensive installation and operation section and testing procedures. Copies of the booklet are available on request.

Write in No. A126 on card, Pg. 17

GUTH INDUSTRIAL LIGHTING BROCHURE — New 8 page, 4 color brochure by The Edwin F. Guth Company, 2615 Washington Blvd., St. Louis 3, Missouri, describes Guth KOLORKODED industrial lighting fixtures. This unique innovation of color coding luminaires opens a new field in industrial lighting. Folder includes photographs, lighting data, engineering information and complete descriptive data on KOLORKODED luminaires and standard RLM reflector units. Write for your free copy.

Write in No. A127 on card, Pg. 17

WIRING DEVICES — Catalog No. 56, and New Product Bulletins, containing the complete electrical wiring device line of Leviton Mfg. Co., Inc. Brooklyn 22, N. Y. Over 100-pages accurately illustrated and containing electrical and circuit wiring diagrams. Complete cross index for easy reference. Featured are Specification Grade Devices, Interchangeable line, Lev-O-Lock line, and many, many others; devices for every possible use in Industrial, Commercial and Residential applications.

Write in No. A128 on card, Pg. 17

ELECTRICAL CONDUITS — "National Electric Conduits" is the 20-page Catalog No. 603 which describes and illustrates the many types of electrical conduits manufactured by National Electric Products Corp., 2 Gateway Center, Pittsburgh 22, Pa.

Write in No. A129 on card, Pg. 17

ANCHORING DEVICES—An illustrated 32-page catalog, No. 70, describing more than 25 anchoring and drilling devices for making fastenings to masonry, is available from the Arro Expansion Bolt Co., Marion, Ohio.

Write in No. A131 on card, Pg. 17

CONNECTORS — Comprehensive, up-to-date information on electrical connections for overhead lines in transmission and distribution is now available in one convenient publication, a 100-page manual issued by Burndy Corp., Norwalk, Conn., on connection techniques, connectors, and installation tooling.

Write in No. A132 on card, Pg. 17

CONDUIT FITTINGS—A new 24-page catalog, illustrating a complete line of conduit fittings, oval bodies type LB, LL, LR, and T, and lighting parts is now available from Elliott Electric Products Co., 1513 Olmstead Ave., New York 62, N. Y.

Write in No. A133 on card, Pg. 17

ANTI-CORROSIVE Paints — Subox, Inc., Fairmount Plant, Hackensack, N. J.(announces the availability of literature on their lines of anti-corrosive paints and coatings. Subox paints give protection for years and largely eliminate the need for scraping and repriming when repainting.

Write in No. A135 on card, Pg. 17

ELECTRICAL EQUIPMENT — A new 12-page pictorial bulletin briefly describes manufacturing facilities and electrical products of Crouse-Hinds Co., Syracuse 1, N. Y. Emphasis is on the variety of equipment available in the four product lines: Condulet electrical equipment, floodlights, aviation lighting equipment, and traffic control.

Write in No. A138 on card, Pg. 17

FEATHERTOUCH .. SWITCHES—Literature punched for standard catalog binders is now available from H. J. Theiler Corp., Whitinsville, Mass., describing the Theiler lifetime Feathertouch switches which feature a unique floating rocker-arm action and whisper-quiet operation. Other features of the line are fast, positive connections, operating in any operation under normal conditions.

Write in No. A139 on card, Pg. 17

POWER OUTLETS—Weatherproof utility power outlets in a wide range of capacities and designs are described in literature now available from Midwest Electric Products, Inc., Mankota, Minn. These power outlets are well suited to many outdoor applications such as temporary services, trailer parks, etc.

Write in No. A140 on card, Pg. 17

LIGHTING FIXTURES — The Harris Electric Manufacturing Co., Smithville, Texas, has available a catalog of their Don-Lite lighting fixtures. The catalog is illustrated and contains information on construction features, applications, specifications, and installation.

Write in No. A141 on card, Pg. 17

COVERED CABLES—A new 44-page brochure is nwo available from Southern Electrical Corp., Chattanooga, Tenn. The brochure is designed to provide the latest available data for the use of Compresto covered cables as weather-proof line wire, duplex, triplex, and quadraplex. It features helpful data on the various coverings of neoprene, polyethylene, two-coat, and the new high-density polyethylene.

Write in No. A142 on card, Pg. 17

CONDUIT FITTINGS — A new catalog describing their line of conduit fittings is now available from L. E. Mason Co., Boston 36, Mass. The illustrated, looseleaf-type folder contains information on design features, specifications, ordering, prices, and shipping.

Write in No. A143 on card, Pg. 17

How three companies use...

G-E Power Grooves for Sales Lighting. If your customers have products to display and sell, G-E Power Groove Lamps can play a vital role, as in the Fontius Shoe Stores, Denver, where 300 footcandles make shoe selection easy—and *fast!*

G-E Power Grooves for High Lighting Levels. Assembly Products, Inc., Chesterland, Ohio, gets 250 footcandles with mighty G-E Power Grooves— eliminated supplementary lighting, and saved *50¢ a square foot initial cost* at the same time!

General Electric Power Groove Lamps

... and get the lighting results they want

Conclusion:

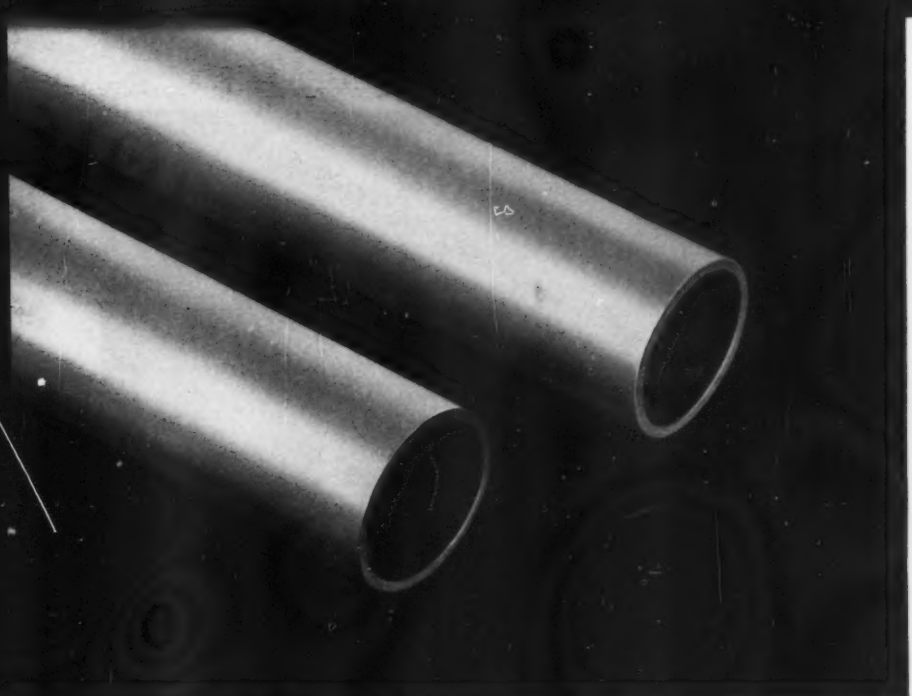
Your customers get more and more light for their money, year after year, with G-E Lamps

What kind of lighting do your customers need? Light with sales appeal? A higher lighting level? Maybe the lowest cost of fluorescent light possible? Chances are General Electric Power Groove fluorescents are the lamps they should consider. Ask your G-E Large Lamp distributor for the whole story. General Electric Co., Large Lamp Dept. C-01, Nela Park, Cleveland 12, Ohio.

Progress Is Our Most Important Product

GENERAL ELECTRIC

G-E Power Grooves for Low Initial Cost. In Murray Hill, New Jersey, Bell Laboratories specified 100 footcandles in this engineering office and got it most economically with General Electric Power Groove Lamps.



Hard galvanized finish for durability; polished satin lustre for lasting good looks.

Even EMT can look good ...if it's CIRTUBE* EMT

TRUE, the first things you look for in EMT are: one, is it easy to work with—two, is it made to give lasting protection. CIRTUBE EMT, by the way, rates tops on both. But there's no reason why EMT can't *look* good as well!

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Proper steel plus! The best cold rolled steel plus the right handling give CIRTUBE EMT its natural bendability.

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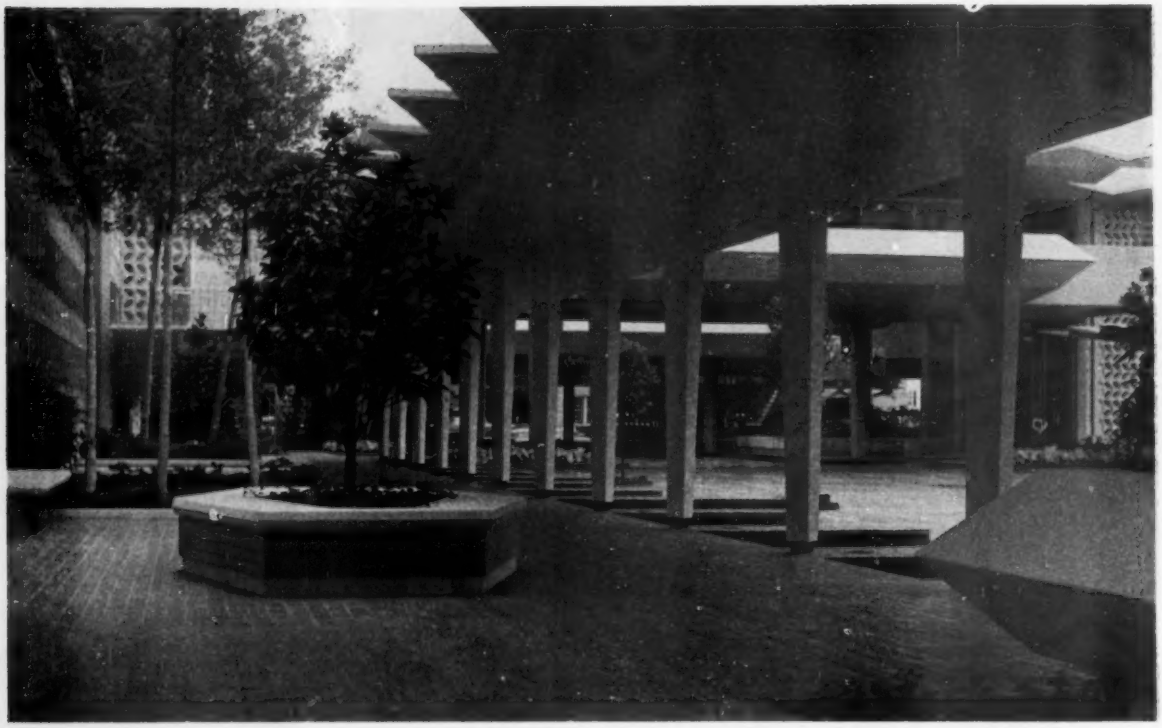
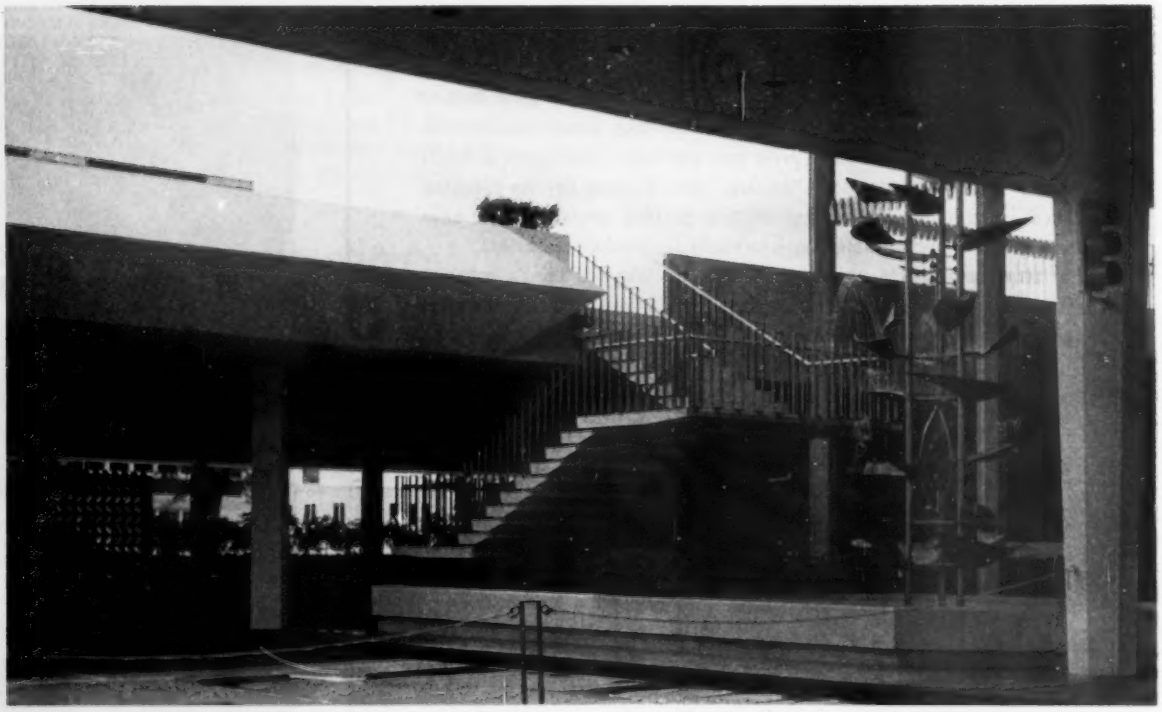
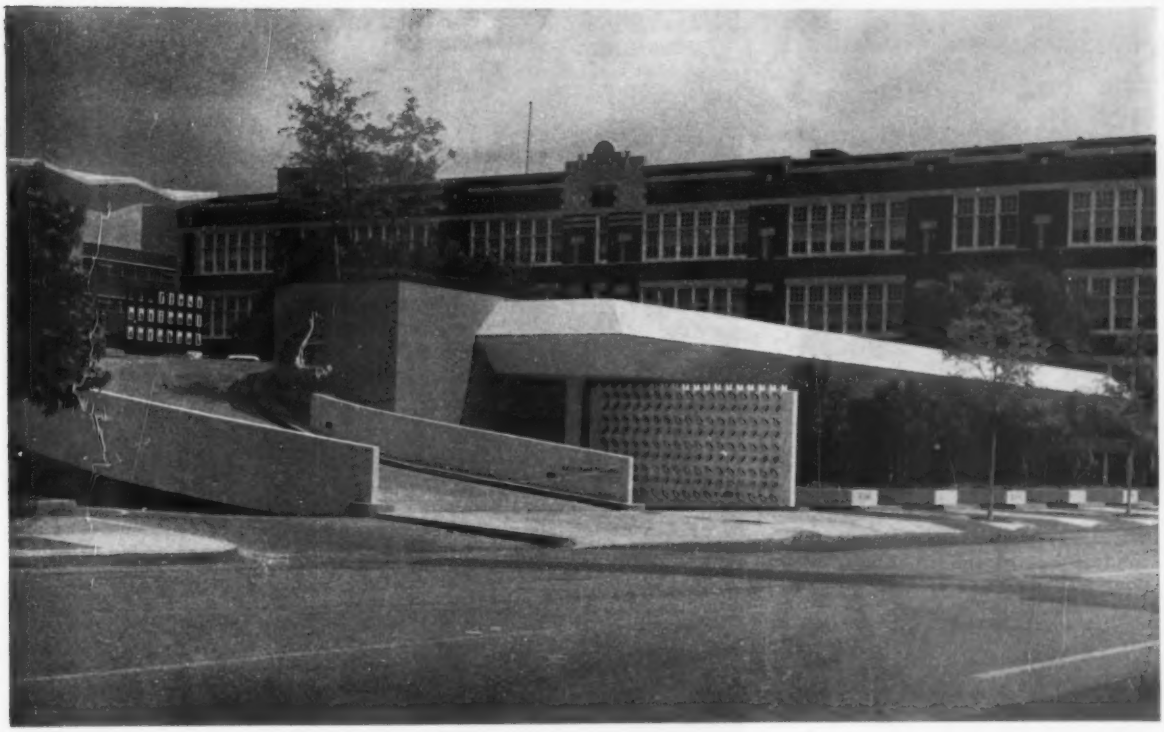


Lighting plays an important part in beautifying the park area of the First National Autobank. Fixtures atop the covered sidewalk light trees and shrubbery. Additional lighting fixtures are in shrubbery beds.



Fixtures for accent lighting sprinkle the floor of the community room (top foreground) and the bottom of the parking deck. Submerged lighting fixtures light the modernistic fountain at the right.



This ramp leads to the First National Autobank's second-story parking deck. Use of cardboard boxes to provide void spaces in the deck slab decreased depth of the deck and reduced steepness of the ramp.

Autobank is lighting showcase but tricky construction problem

By Ken Kirkpatrick

This article should be especially helpful to the following readers:

- Electrical Contractors ✔
- Electrical Utilities ✔
- Electrical Wholesalers ✔
- Electrical Inspectors ✔
- Industrial Engineers
- Consulting Engineers ✔

◆ A NEW TYPE of concrete construction and numerous unusual electrical features made the beautiful new First National Autobank, Tulsa, Okla., a challenging job for West Electrical Construction Co., of Tulsa.

Lighting effects are a prominent part of the over-all design of the First National Autobank. Walls, shrubs, trees, fountains, and signs all show the result of skillful coordination of lighting and structural shape.

"This building is a real showplace, but it gave us problems that we don't experience on the average construction job," said Pinky West, co-owner of the firm with his son, Allen D. West. "We had to cope with an entirely new method of concrete slab construction, and we also had many unusual wiring features on this job."

West stressed the special value of working closely and harmoniously with other trades on this particular job. "Our policy of putting only top-notch foremen on each job paid off for us here," West said. "Our foreman's ability to maintain a friendly, cooperative feeling between our men and the other trades helped us reduce lost time that could have been especially costly on such an unusual job."

The First National Autobank has a parking space on the second story. The deck is 21 inches thick and has hundreds of hollow spaces 15½ inches deep, 26 inches wide, and from 5 to 13 feet long. These voids were provided by enclosing corrugated cardboard construction pans inside the slab.

Each section of the 140 x 187 foot slab was poured in two parts. First, a 3-inch slab was poured. After the slab hardened properly, the cardboard boxes and reinforcing steel were placed and the top

Wire was pulled through all the conduit before the final concrete pour was made.

Workman at left stands on a completed portion of the deck. The slab was poured in sections at different times and so caused added problems.

The boxshaped frames shown here in the bottom pour of the Autobank parking deck slab formed the openings for the fluorescent fixtures.

pour made. The total depth of 21 inches left 2½ inches of concrete above the boxes. Joists were provided by 4-inch spaces between boxes.

This unusual construction technique was used to avoid the deep beams that would have been required to support the building's open spans, some of which are as long as 44 feet. The thinner slab resulting from this construction method reduced the steepness of the car ramp leading from the street to the second-floor parking space. This method also provided a smoother, more attractive ceiling for the first story drive-in area than the waffled effect that results from using conventional construction pans.

Slab presents problems

This slab construction method made several unusual and time-consuming electrical construction procedures necessary. First, lighting fixtures with concrete enclosures and wooden frames to provide openings for flush fluorescent fixtures were placed before the bottom 3-inch slab was poured, but conduit was not run until after this pour was made. All wires were pulled through conduit before the top part of the slab was poured because the many bends made necessary by the wiring layout would have made wire pulling through the fixtures later much too time-consuming. After the slab was completed, the framed openings for the fluorescent lighting fixtures were removed and the fixtures installed.

"We were slowed up further because the slab was poured in several sections and at different times," said West. "This meant that we had to wire this job piece by piece. Also, there was little repetition of the same type of installation. It seemed that no two areas were alike, so each part of the job had to be laid out individually."

Another problem was that some of the steel reinforcing rods had to be adjusted so that fixtures could be placed in their proper positions. Stub-ups from the bottom section of the 21-inch slab were installed before the cardboard construction pans were placed. West handled this by preparing stub-ups in advance so that workers could install them easily. Conduit installed in the top 2½-inch section of the slab was coupled to the stub-ups after the boxes were placed.

The wall around the parking deck is a triangular, hollow shell. Lighting fixtures were installed inside the shell to illuminate the

front of the autobank. Other fixtures also installed here illuminate the street-level flower and shrubbery beds. Separate fixtures installed in the sidewalk uplight trees planted in front of the autobank.

The community room and the covered sidewalks in the park area have lighting fixtures beneath the folds of the folded concrete roofs. These fixtures are powered from conduit that runs up supporting columns and out to the fixtures.

Special installations

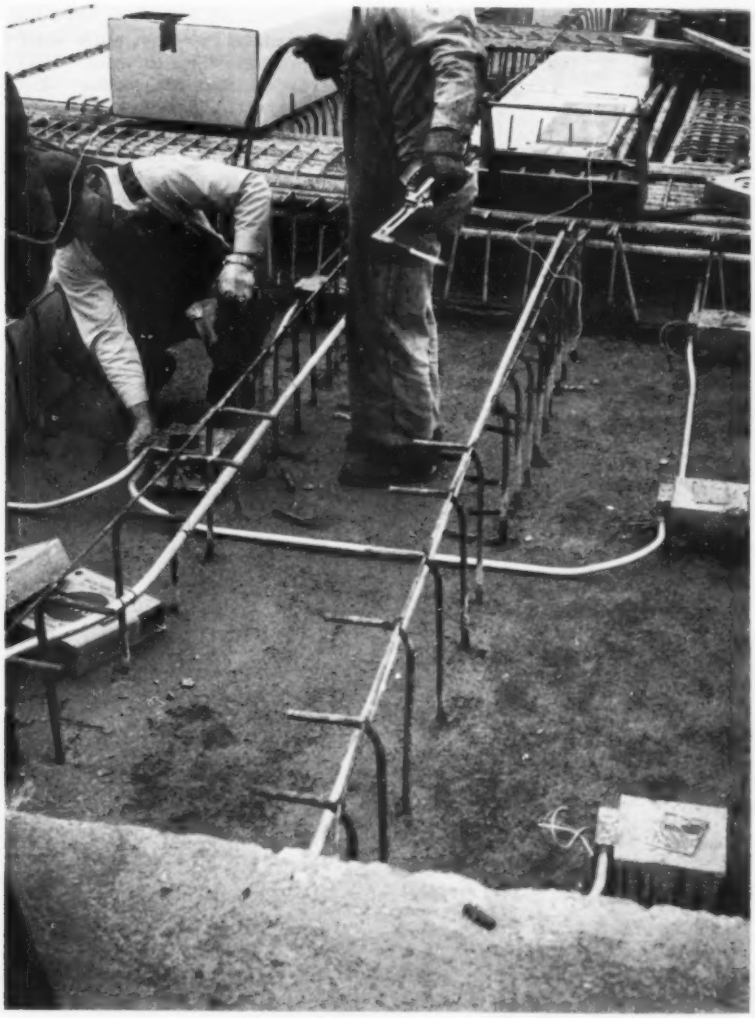
"We found that the many specialty items installed were quite a problem. And this job was certainly loaded with wiring methods that are not normally encountered," West said.

Several communication and control circuits were installed from the autobank to the parent bank building 1½ blocks away. These circuits included a closed-circuit television system, heating and air conditioning controls, and controls for a pneumatic tube system which interconnects the main bank building, a basement money-handling room at the autobank, and the six teller cages. The pneumatic tube system includes blowers in the basement and controls that turn the autobank blowers on when blowers in the main bank building start.

The television wiring consists of coaxial cable running from a camera at the main bank building to television receivers in the sidewalk teller cage, each of the six drive-in cages, and the teller stations in a ground-floor banking room for pedestrians. The camera televises signature cards from the parent bank so that autobank tellers can verify customers' signatures before cashing checks.

Among numerous other special circuits installed were traffic signal lights. The autobank is on one side of an alley and a landscaped park-entrance area is across the alley. The traffic signals were installed to give the right of way to cars passing from one part of the autobank to another except when traffic in the alley rolls across a signal actuator embedded in the alley.

A system of teller identification lights was installed to show customers which of the six drive-in teller cages are open for business. Bank guards operate these lights from a control panel.



These fixtures, which would eventually be enclosed in voids within the concrete deck, were first installed in the lower concrete slab. Cardboard boxes were placed on this bottom slab with sections cut out to fit around conduit and fixtures. Top slab was poured over the boxes to form beams and voids.

Alarm circuits installed

Several alarm circuits were installed to protect against robberies. A concealed alarm button inside each teller cage can be pushed by the teller in case of attempted robbery. The guards' control panel is wired with an alarm bell and indicator lights to show which teller has sounded the alarm. Additional lights outside each cage turn on when the alarm button is pushed. Another protective circuit is a night burglar alarm system which sounds an alarm in Tulsa police headquarters in case of attempted robbery.

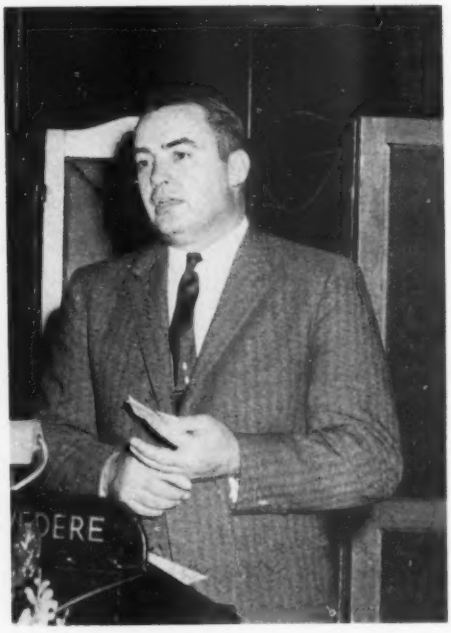
Electric money elevators are installed in each teller cage to carry money between the basement and the teller cages. An electric passenger elevator is also installed from the basement to the ground level and the second story.

The community room has fluorescent lighting both outside and inside. It is also equipped with an all-electric kitchen, including oven, range, and water heater.

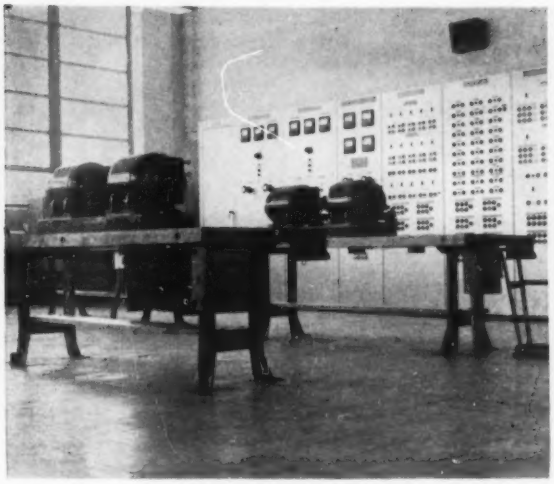
"Our experience on this job makes us think that the labor factor should be increased at least 25% in estimating wiring for buildings that use this type of concrete void construction," said West. "This is certainly true when additional specialty items must also be installed."

(Above) 1959 graduating class with Philip Vail, program director seated center. (Left) Joint committee members and NECA officials at graduation ceremony. Left to right, Lester Bley, president, Maryland NECA Chapter; George Freund, committee member; Robert Higgins, committee chairman; Carl M. King, committee member; John Beck, NECA vice-president; Samuel Adams, committee member; and Philip Vail, program director.

Apprentice program instructors at Mergenthaler Trade School, seated left to right, Robert Niemeyer, Wayland Spilman, Melvin Keller, Rudy De Laughter, Delmar Spedden, and standing, William Selway, David Meade, Philip Vail, program director, and Gilbert Thompson



Robert Higgins, joint committee chairman, and manager of the Baltimore Chapter of the National Electrical Contractors Association addresses new journeymen and guests at the graduation.



In addition to the on-the-job training, the apprentice studies at night at Mergenthaler Trade School. He is required to take 576 hours of classes. Pictured here is one of the classrooms used for apprentice classes.

Robert C. Joyce, Jr. fourth year apprentice gets instruction from Joe Beckhardt, Jr., 20-year journeyman. Apprentices receive 8,000 hours of on-the-job training supervised by journeymen and foremen.

Electronics added to apprentice program

By Jack James

This article should be especially helpful to the following readers:

Electrical Contractors ✔
Electric Utilities ✔
Electrical Wholesalers
Electrical Inspectors
Industrial Engineers
Consulting Engineers ✔

◆ RECOGNIZING that it is a matter of years, not decades, before automated factories dot the South, Baltimore electrical contractors are preparing to win installation and maintenance contracts on the millions of dollars of electronic equipment that will control these plants in the Baltimore area.

This fall apprentices started studying electronics, reports Phillip T. Vail, director of the Joint Apprenticeship and Training Committee for the Electrical Industry of Baltimore. They will study in two modern, fully equipped, electronic laboratories at Mergenthaler Trade School. The laboratories are furnished by the Education Division of Adult and Vocational Training, Baltimore Department of Education, which cooperates with the apprentice program.

"When the big demand for journeymen trained in electronics arrives, we intend to have trained men so our contractors can bid for the jobs," Vail asserts.

This venture into electronics is just one phase of a comprehensive apprenticeship training program that for years has assured members of the Baltimore National Electrical Contractors Association of highly skilled, well-rounded journeymen electricians.

Records show that with the graduation of the present senior class in May, 554 journeymen will have completed the program within the past eleven years. That is a bit less than half the 1,300 journeymen that Baltimore NECA members employ. The apprentice training program itself started in 1935. (Records prior to 1948 are incomplete.)

Beginning of the program

For the apprentice, the program begins after a thorough screening by the joint apprenticeship committee. First the applicant must be between the ages of 18 and 25, have a high school education, and have passed an aptitude test covering mental ability, mechanical insight, mechanical comprehension, spatial perception, and finger dexterity.

"We want only the best youths to take our program," Vail declares. "Last year we had 225 youths to apply. We accepted only 45."

That only the best do survive this thorough testing and screening is shown by the fact that Vail seldom has a problem placing even a first-year apprentice with a contractor.

After qualifying, the youths sign apprenticeship agreements with the Joint Committee and the U. S. Department of Labor.

The training program starts. It is similar to the program set forth in the booklet, "National Apprenticeship and Training Standards for the Electrical Contracting Industry." This is a program worked out by the NECA, the IBEW, and the Bureau of Apprenticeship and Training, U. S. Department of

Labor. Apprentices who complete the course are certified by the Labor Department as journeymen.

In brief, under this program the apprentice gets 8,000 hours of on-the-job training divided this way: 500 hours, residential wiring; 500 hours, commercial fixture work; 3,000 hours, industrial plant installation; 400 hours, metal molding installation; 200 hours, meter trouble and repair; 1,000 hours, official building installation; 2,000 hours general wiring installation; 200 hours, maintenance work; and 200 hours exterior sign work.

The apprentice works directly under the supervision of journeymen and foremen.

Night school

In addition to the on-the-job training, the apprentice studies at night at Mergenthaler Trade School. He is required to take 576 hours of classes during apprenticeship. Except for the summer, when there are no classes, school takes up about six hours of his week and outside preparation adds a few hours more.

In his first year the apprentice studies mathematics, blueprint reading, and basic electricity.

The second year program includes electrical theory, series and parallel circuits, motors and generators, and the National Electrical Code, Articles 100 to 250.

The third year apprentices delve into the study of a-c motors, alternators, transformers, inductance, capacitance, power factor, and the National Electrical Code.

In his fourth year the apprentice studies transformers (single-phase, three-phase, instrument transformers, connections) and a-c motors (all types controllers and connections).

In all classes the apprentices receive training in both theory and laboratory work.

Final examination

After this four-year stint, the apprentice, if he finishes satisfactorily, and not all do, receives a comprehensive examination. A three-man board of qualified examiners tests the apprentice.

"Our program allows the electrical contractors to have a voice in setting the highest possible standards for journeymen," Vail points out.

"The curriculum is constantly being revised and developed to keep pace with the rapid changes in the electrical industry. The revisions are made with the cooperation of the faculty composed of journeymen electricians, electrical engineers, and professional teachers, the Board of Education, Bureau of Apprenticeship Training, and the National Joint Committee."

Philip Vail, aprentice training program director, points out to an apprentice applicant the welfare benefits that contractors pay.

The history of Baltimore's electrical apprentice program goes back to 1935 when Local 28, IBEW started its own apprentice training. Until 1938 classes were at union headquarters. That year expansion forced a shift to a public school. In 1949 the program became full-fledged. Department of Labor Standards were met. Apprentices signed agreements with contractors and union. In 1952 contractors assumed joint responsibility with the union for directing the program.

The date for the establishment of the Joint Apprenticeship Committee was March 26, 1952. Robert L. Higgins, manager of the Maryland Chapter, NECA, became chairman, and has held that post since. The chapter and the union each pay half the committee costs. Each has three representatives who serve three-year terms. One union and one management representative are appointed every year.

Committee members

Management representatives on the committee at present are Paul Goldberg (Harry A. Goldberg Electric Co.), Eugene Newton (E. W. Newton Electric Co.), and Charles Emich (Riggs Distler Electric Co.) Union representatives are Carl M. King, Local 28 business manager, Samuel Adams, and George Freund. These members serve without pay.

It is this committee which supervises the apprentice and directs his activities. As director, Vail sees that the committee's policies are followed.

Enrollment grows rapidly

Vail took over as full time director of the apprenticeship program in 1953, and under his direction enrollment has almost doubled, jumping from 164 apprentices in 1952 to 320 this year.

Each month Vail receives progress reports from each apprentice. He checks them all. On the report there are 21 categories and a miscellaneous category. The categories cover everything from temporary wiring to shop work. The apprentices write in how many hours a day they work in each category. If an apprentice gets too much of one type of experience at the expense of other experience, Vail has him switched. Every six months Vail studies rating reports submitted by the contractors for each apprentice. If a youth needs advice and guidance, Vail gives it to him.

Class work is also rated regularly, and apprentices are tested at the end of each semester. Class attendance is compulsory. Failure to attend regularly means expulsion from apprenticeship.

"There is no doubt about it, the program is tough," Vail asserts. "But once a boy has completed it, he can go out on almost any job. Our goal is to produce journeymen who will earn the high wages which Baltimore electrical con-

(Continued on page 100)

Charles Breaux (left), Supreme plant engineer finishes up the installation.

Breaux flips circuit breakers and sends power to the machinery to start refinery again after an interruption of only 10 hours.

Modular panelboard shortens outage time

By Charles Breaux

Plant Engineer
Supreme Sugar Refinery
Supreme, Louisiana

This article should be especially helpful to the following readers:

- Electrical Contractors ✔
- Electric Utilities ✔
- Electrical Wholesalers ✔
- Electrical Inspectors ✔
- Industrial Engineers ✔
- Consulting Engineers ✔

◆ THE IMPORTANCE of keeping up with new developments and new products was forcibly brought home to the Supreme Sugar Refinery, Supreme, La., when at exactly 6:15 on a Sunday morning, the 600-volt panelboard that distributed power to the entire refinery, burned out.

The refinery, one of the largest in the state, was knocked out as completely as if it had been struck by a fire or flood. The refining process was stopped immediately, and with it a daily production of 1,400,000 pounds of sugar was halted.

The situation could not have been more serious. The panelboard that had burned out was an obsolete unit, and to get a duplicate of that outmoded panel meant ordering one from a factory hundreds of miles away, then waiting for it to be custom-made. This would take at least two to three weeks, with a loss to Supreme Sugar of possibly 20,000,000 lbs of sugar.

In this nearly disastrous situation, our practice of allotting a certain amount of time each week to investigating new plant and production developments, paid off. We remembered that a representative of Federal Pacific Electric Company had visited Supreme Sugar six months before to talk about one of his company's new products—a pre-fabricated standardized panelboard made up of modular units.

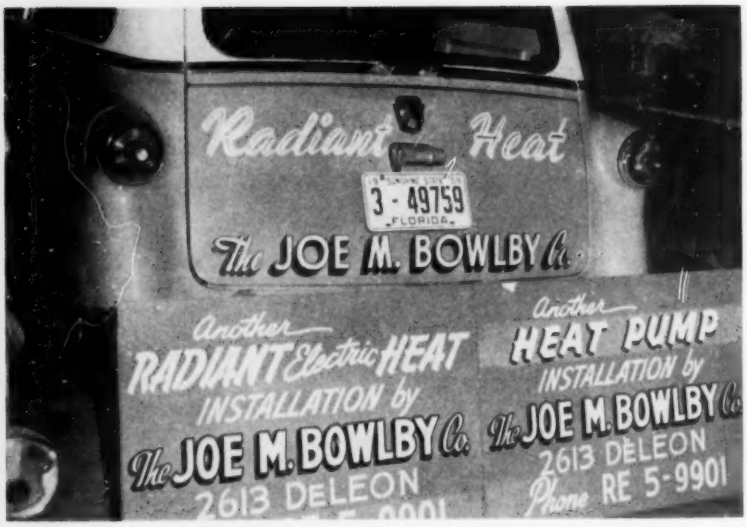
The main advantages of this panelboard, as pointed out that day, seemed the answer to Supreme Sugar's problem. First, because the panelboard was available from a local electrical distributor, it could be delivered fast—in fact, right over the counter. Second, because the breakers plugged into the board and the whole construction was modular, installation was fast and easy.

At this point, the representative was called in New Orleans, and over the telephone, Supreme Sugar explained its predicament. As expected, there was no trouble meeting requirements. The new-type panelboard line was made up on standard components, four basic enclosures and the proper combination of single, double, and triple three-pole breakers able to handle all main services from 225 to 600 amperes.

Finding out the particular components that Supreme Sugar would need was not a problem either. All the refinery had to do was: (1) list the branch circuits; (2) determine the number of mounting space units; (3) calculate the panel size for the required mounting of space units; and (4) select the breakers

(Continued on page 100)

Electric



Signs such as these, placed at construction sites, identify the Bowlby Company with the job and tell the type of electric heat being installed.

By Harry J. Miller

This article should be especially helpful to the following readers:

- Electrical Contractors ✓
- Electric Utilities ✓
- Electrical Wholesalers ✓
- Electrical Inspectors
- Industrial Engineers
- Consulting Engineers ✓

◆ WHENEVER the subject of electric heat comes up in West Coast Florida electrical contracting circles, the name of Tampa Contractor Joe M. Bowlby invariably enters the discussion.

The reason for this is that Bowlby pioneered in electric heat installations long before contractors were urged into this lucrative field by the impending threat of natural gas and today's frenzied efforts on the part of gas dealers to capture the home's heating load away from the electrical contractor.

"The electrical contractor is the logical man to get this work," says Bowlby." He's first on the ground with his temporary service pole, and some aggressive salesmanship can secure him the heating contract. In turn, the heating contract can lead to air conditioning work. If the contractor doesn't make a determined sales effort in that direction, he'll find the air conditioning lads will pull this carpet right out from under his feet!"

Illustrating the effect of Bowlby brand of salesmanship is the fact that the local power company, Tampa Electric, had, as of January 1, 1959, 2,506 homes on its lines wired for electric resistance heating out of a total of some 120,000 residential customers. This compares with 1,510 heat pump installations and 3,733 window-type heat pump units.

Bowlby's firm has made over 1,700 heating installations. Recently it completed the wiring and installation of twenty-eight heat pump units at a cost of $1,500 each, for a housing subdivision. Bowlby has three outside salesmen contacting every possible source of jobs.

Quality given credit

"We can only credit our success in this field to the fact that we install a quality job," says Bowlby. "Sure there are times when we're not the lowest bidder, and it's no disgrace to lose a job. But it is a disgrace to get an unsavory reputation for work that kicks back from the home buyer to the contractor who built the house. He isn't likely to forget or forgive when he builds again."

As evidence of the proved quality of Bowlby installations, architects specifying electric heat frequently pinpoint the electrical contractor by including Bowlby's name right in their specifications!

Bowlby salesmen carry along with them a comprehensive list of satisfied customers. A skeptical prospect is rushed out to hear the comments of a user of electric heat, and this word-of-mouth advertising is the firm's brightest and most effective sales stimulant.

In addition, for the past two years, electric utility companies across the land, have offered attractive reduced rates in 40 states across the country to induce new home buyers to use various types of electric heating systems—resistance type, wall, or ceiling installations and heat pumps. Tradition is not easy to overcome, however, and costly fuel-fired heating installations, especially for commercial buildings continue on the drawing boards.

Thus, the alert electrical contractor needs to have the professional foresight and initiative to convince homebuyers and builders of houses and commercial structures that traditional heating systems are not only excessively costly to install and maintain, but they are also already obsolete by the best modern heating concepts of today.

Approach to the builder

Bowlby finds that the architect and builder are approachable from the standpoint that electric heat is free from the complex physical and mechanical considerations involved, say, for wet heat systems.

"For example," says Bowlby, "even in the case of an oil wall heater 3 x 3 feet, the unit takes up 9 square feet of usable floor space. At $10 a square foot, the builder has given over $90 to it."

Even though electric heat offers impressive advantages, especially in low, loosely-coupled, ranch-type homes that dot the Southern landscape as well as in sprawling commercial structures, Bowlby feels it imperative to aggressively seek this business.

"If your men make enough calls, they're bound to get results," he points out. "Trouble with some contractors is they don't take time out to study and properly plan an installation. They simply ask the wholesaler: 'Gimmee a cable for a 12 by 12-foot room.' They're handed a 1,000 watt cable. When it comes to installing it in a ceil-

heat, hot profit item in Tampa

ing, correct spacing is forgotten, and if a spacing of 3 inches is begun, chances are this is carelessly permitted to wander until it winds up 12 inches apart.

"If the length hasn't been properly figured, it means the excess is bundled up into a wad and poses a fire hazard."

Cable, specially ordered

Bowlby insures a quality job by installing cable made especially to his order. The correct cable is used only after due consideration of such vital factors as heat loss and how much wattage each room should have, figuring room by room and the whole house.

"We don't just buy cable," this successful contractor says.

"You have to figure the spacing in a room to get the most possible heat out of the cable. All the imbedded wire should get 150 degrees. With a plastered ceiling you need to get 88-90 degrees. A hand on the ceiling and one on your cheek should feel of equal warmth. An underheated job is obviously a poor one, and an installation that is overheated cracks the plaster and makes the homeowner or builder unhappy. Such mishaps can be avoided in the first place if the job is properly figured, properly installed, and properly profit-making."

Bowlby says that in 1,700 installations he has never had a kickback.

"Our price may be higher than other contractors'," he adds, "but we're not bidding against just any other contractor. We're bidding on a quality job, and that's what it has to be or we don't want the contract. You can't land every job you bid on, but we'll never accept one at such a figure that the only way we could come out on it would be to make a sub-standard installation."

"For example, while we could get by with 4 inches of insulation over the entire living area when installing a heat pump, we'll use 6 inches. Four inches would make the unit run longer, with higher operating costs. And our heating systems hold to only a 4-degree difference between the ceiling and floor temperatures."

Heat pumps stressed

Bowlby finds that when a customer shows an interest in heating and air conditioning, it is best to concentrate the sales pitch on a heat pump, that provides all-year control of air movement.

His reasoning stems from the fact that the local utility is actively advertising and promoting heat pumps, while resistance heating is not so openly promoted as yet. However, electric resistance heating installations have in no way been discouraged.

"We're heating in Tampa at a cost of 5 to 6 cents a square foot," says Bowlby, "with electric rates at 1½ cents per kwh after 125 kwh in the county; after 400 kwh in the city.

"A 1500 square foot house runs up a bill of $80-$90 for heat in an ordinary winter season and here we have an average of 570 degree days for every point below 65 degrees."

"Since many old homes in our area are inadequately wired, we often get the job of revamping the service to include heating and air conditioning," adds Bowlby. "We can save 2 tons of air conditioning by insulating the floor, and while we take our figures off the plan of a new structure or old house, we insist our salesmen crawl beneath the building or through the attic, to make sure of the type of construction or obstacles which might

(Continued on page 99)

Bowlby believes study and meticulous planning of every job is the key to quality work and success.

With the popularity of electric heat on the rise, Bowlby keeps adequate stocks in his warehouse-office.

Contractors tell how

Human relations, all-important on every job

By Ray A. Peters
Estimator
Becker Electric Co.
Alexandria, Va.

◆ CONTRACTORS are prone to count job savings in dollars and cents with one eye on time losses that mean a reduction in net profit. Yet the importance of establishing good human relations with other trades on the job is something no contractor can honestly deny.

Workmanship is ultimately the test of a good installation, and a good job is dependent upon the cooperation of the bricklayer, plasterer, carpenter, plumber, and electrician. How well they can pool their effort and skill may mean the final success of an installation.

Our first consideration upon arriving at a new job is becoming acquainted with the job foreman, and in time, we like to have some friendly contact with every helper, mechanic, and foreman working with us on the job. The assistance we can give each other has untold value and savings, not written in the specifications, nor spelled out in the blueprints or contracts.

A plumber may be cutting a hole through a 6-inch concrete floor. If we are on friendly terms, he will not hesitate to cut the hole an extra three inches at our request for conduit we want to run to panels on each floor. Or a carpenter similarly may accommodate us when he is framing a rectangle 8-inch X 4-inch so that when the concrete is poured, a hole left in the floor will be large enough for our conduit.

If there is a good relationship between us and the mechanics of the other trades, they will make an extra effort to avoid any conflicting circumstances on the job. For instance, when the plumbers run their water lines, cooperative understanding helps them to be especially careful not to run their pipes in the way of our conduit.

We try to have some knowledge of the problems of the other trades on the job, and we offer them assistance in any way that we can. We supply temporary power to all trades working on a job with us. These are little things that are not in a contract but come under human relations.

We know plumbers need light, and we will provide the lights they use. In a recent case where a plumber's waterlines had to be rerouted to make way for our conduit, this was cheerfully done and promptly carried out to our satisfaction. The plumber recalled how accommodating we had been several years before on a job when we furnished him with much needed light and power in a particular situation.

Good human relations often pay off better than penny-saving schemes. A good job carried out cooperatively among skilled mechanics of the different trades is something to be proud of and leads to better customer relations, also.

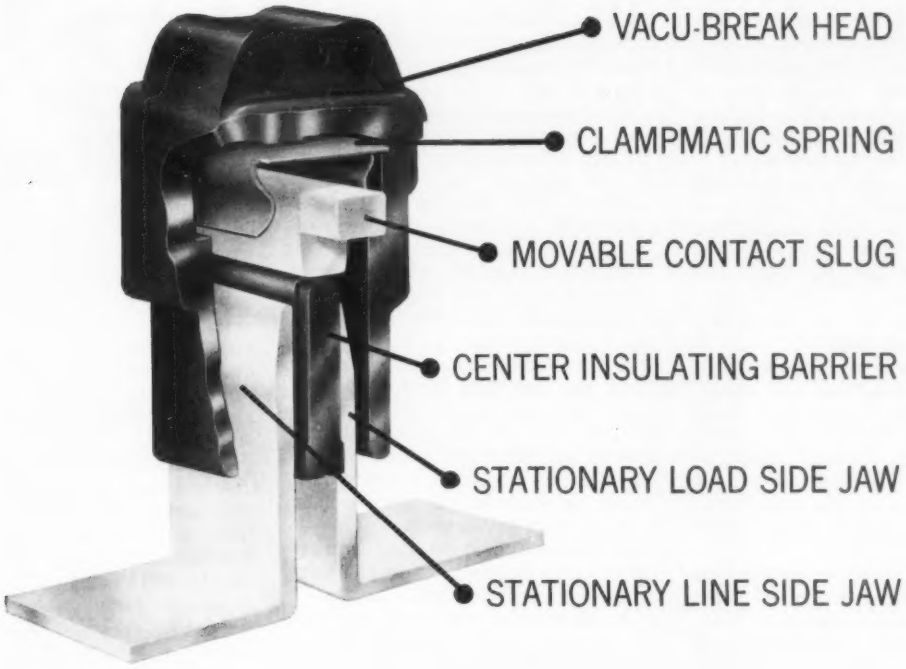
The first thing Frank M. Becker, Jr., of Becker Electric Co., Alexandria, Va., does on a new job is become acquainted with the construction foreman. Here he introduces himself to Foreman Talbert.

Maintaining a balance of equipment versus high equipment investment

By Elmo Duke
Duke Electric Co., Inc.
Amarillo, Texas

◆ TO KNOW when to buy new or used equipment, or whether to rent it, can mean a big saving in overhead for the electrical contractor.

In this day of highly competitive business, the contractor must avail himself of all labor-saving devices that can justify their purchase.



INCREASED SWITCH LIFE WITH CLAMPED PRESSURE CONTACT AND VACU-BREAK ARC CONTROL

You get longer switch life from BullDog safety switches, thanks to unique BullDog design. The high-tension Clampmatic® spring puts pressure where it belongs—on contact faces after the switch is "ON." This clamped pressure action assures good electrical contact for the life of the switch. It means the switch lasts longer, too, for there's no overheating to damage switch components. In switching "OFF," the pressure's removed before the "break" . . . providing true quick-break action.

Vacu-Break® design is another reason BullDog safety switches last longer. Switching contacts are completely enclosed in the Vacu-Break head. Arcs are restricted, starved of oxygen, cooled and smothered quickly. In addition, Vacu-Break *double*-breaks the circuit, effectively reducing the arc length and arcing time.

Vacu-Break arc control plus clamped pressure contacts add up to long switch life . . . and dependable, economical service for you. You'll find BullDog safety switches need little or no maintenance over years of heavy-duty use. See your BullDog products distributor.

FOR SAFETY'S SAKE—BUY VACU-BREAK!

BULLDOG ELECTRIC PRODUCTS DIVISION
I-T-E CIRCUIT BREAKER COMPANY
BOX 177 • DETROIT 32, MICHIGAN

In Canada: 80 Clayson Rd., Toronto 15, Ont. Export Division: 13 East 40th St., New York 16, N.Y.

Consult the following Southern representatives:

Wilson Electrical Equipment Co.
3210 Garrow St., P. O. Box 1725
Houston, Texas

Wilson Electrical Equipment Co.
101 E. Maple Street
San Antonio, Texas

Standard Electric Mfg. Company
2401 Federal St., P. O. Box 1138
Dallas 1, Texas

Walker Electrical Co., Inc.
125 Bennett St., N. W., P. O. Box 2308,
Station D,
Atlanta, Georgia

It is well established that if a contractor has daily use for a machine, he should by all means purchase a good one—preferably brand new; however, the tool or truck that is needed only occasionally is the "fly in the ointment."

In our past experience we have seen several contractors fail, due in great part to their overbuying of equipment. We first must attempt to evaluate the need and decide whether to rent or purchase; then if we are to buy—whether new or used.

Over the years we have accumulated a reasonable tool and equipment inventory. We bought more than half of it "used," and according to our cost records, this was the answer to keeping our investment down and at the same time "having the right tool at the right time."

We have followed this same rule regarding office machines and even our two-way radio system. For instance, by purchasing used equipment as separate components, our two-way radio system cost us about $2,200, whereas a complete, new system sells for around $4,500.

Whereas a new winch truck and A-frame markets for about $5,000, we put one together at a cost of $1,350 because the truck, bed, winch, and A-frame were bought separately and were used equipment. Since we might go 30 days without a need for a winch truck, it would have been foolish to buy it completely new. We have had the truck for five years, and it is still in good shape. Repairs on it have run less than $100 a year.

In the case of a bookkeeping machine, we did not feel that our operations justified a $3,000 to $20,000 machine, but a used machine at six-hundred dollars has been a good investment.

Many items of good, used equipment are offered through our trade association surplus sheets.

A contractor can save money by using his head regarding these equipment purchases.

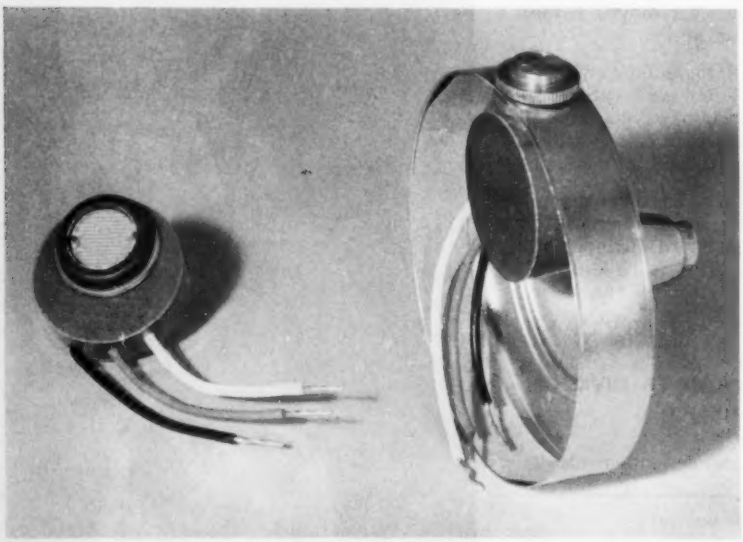
Compact, light-operated switch introduced by contracting firm

◆ RECOGNIZING the need for a compact light-operated switch, Schacht Electric Co., electrical contractors, has developed and made available the Lightguard switch, which has a long list of applications. Its small dimensions (one and three-quarter inches in diameter) and shape make it suitable for installation in lighting fixture canopies, outlet boxes, post lanterns, and within magnetic contractors and starter cabinets.

The Lightguard is designed to turn off at approximately one footcandle. Some of its applications are on-at-dusk off-at-dawn residential and commercial light control, such as outside lights both wall and post mounted; protective night lighting to serve as a burglar deterrent; safety warning lights around construction projects; billboards, neon signs, and store night lighting; starting and stopping of air conditioning systems in offices and plants.

The location of the light-sensitive element is variable, making the Lightguard adaptable to the fixtures of most manufacturers. Electrical contractors will find the Lightguard easily installable by drilling or punching a ⅜-inch pipe size knockout in fixture canopy or electrical cabinet. A short three-inch adapter is available in steel or aluminum for mounting on post lanterns. Other adapters are also available for mounting with wall brackets with shallow canopies.

Currently manufactured models are suitable for tungsten loads up to 150 watts on 120-volt, a-c circuits.



The Lightguard switch, manufactured by Schacht Electric Co.

Checking everyone you do business with pays in many ways

By C. M. Whalen
President
Allen and Whalen, Inc.
Rockville, Md.

◆ OUR ACCOUNTS receivable have been in excellent shape for the last four years, because we have been checking everyone we do business with.

Sad experience in collections in the past has taught us to shy away from the general contractor with a bad reputation with sub-contractors, the one well-known as a chiseler or broker, and the general contractor inefficient in handling government work, who gets so wound up in red tape and his poor

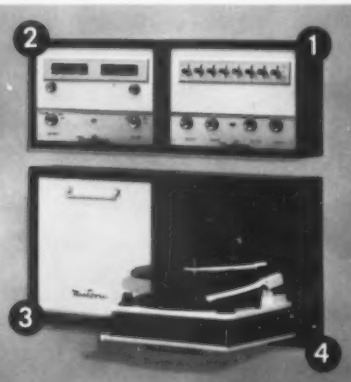
(Continued on page 101)

NEW

NUTONE BUILT-IN STEREO COMBINED WITH AM & FM RADIO, INTERCOM, HIGH FIDELITY MUSIC

Now you can offer STEREO through the entire house, not just in a single room. No costly console cabinets. . . No wasted floor space! Everything is built-in. Fits standard 4" studding.

Arrange the components you want to suit your own plans. The moderate cost will surprise you . . far less than the same units in cabinets.



It's new . . it's beautiful . . it's Stereo . . plus the step-saving convenience of Intercom . . plus am-fm Radio . . plus High-Fidelity music . . combined in the NuTone Built-In Stereo System.

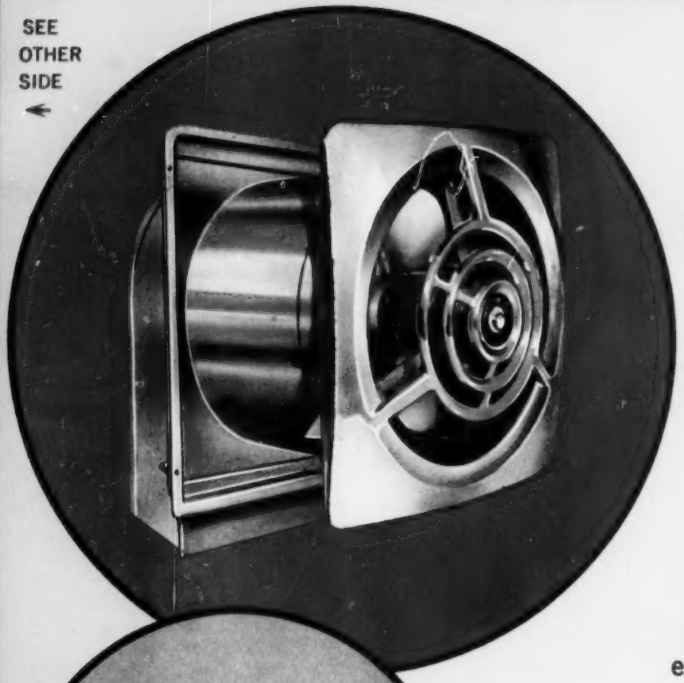
Built-In Wall Speakers offer the finest tone because no cabinet can match their rigidity and size. The complete system is engineered for easy operation.

Here is an exciting idea for your 1960 homes . . a real luxury . . which adds many times its cost to the home value.

1. Dual Chassis Amplifier . . . also contains Intercom Controls..
2. AM-FM Radio Tuner . . . receives two programs at the same time.
3. Built-in Cabinet for Record Storage . . or Cartridge Tape-Deck..
4. Fold-into-wall Record Changer. 4 speeds. Automatic shut-off.
5. Wall Speakers with controls for Intercom . . Balance . . Volume.
6. System includes Door speaker, Remote controls, Outdoor Speakers.

SEE OTHER SIDE ⟶

SEE OTHER SIDE ←

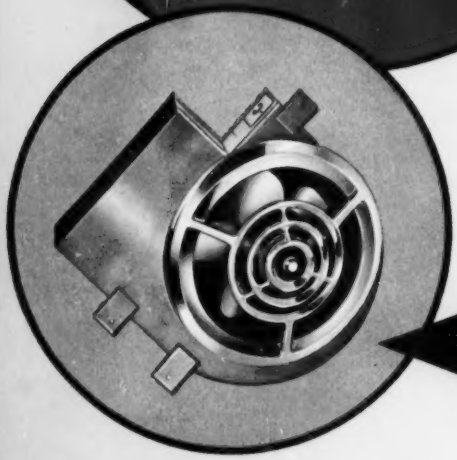


NUTONE'S *New* *Jet-Power* FANS

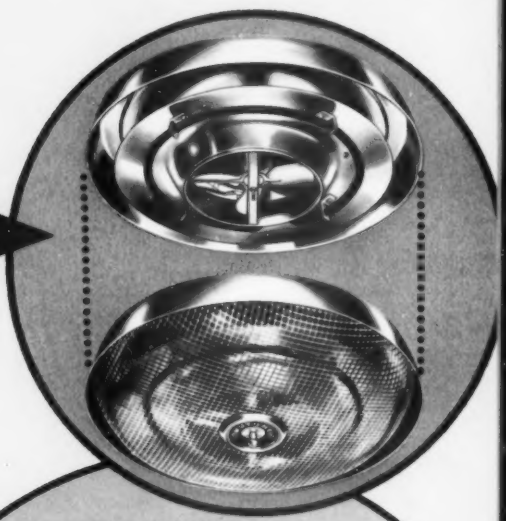
CRISP, ULTRA-MODERN STYLING!

NuTone offers America's Newest Exhaust Fans. Completely redesigned for beauty and luxury . . engineered for power and performance. Changed in every way — except the price is the same!

Sparkling anodized grilles for the "Jet-Look". Improved motors and blades for "Jet-Power". Nine new models for wall and ceiling . . Pull-Chain or Automatic . . Horizontal or Vertical Discharge . . All NuTone Exhaust Fans meet or exceed FHA Minimum Property Standards. (MPS.)



NuTone



NUTONE'S *New* *Ceiling* HEATERS

"BUILT-IN" OR SURFACE MOUNTED

New slim-line styling that hugs the ceiling! Your choice of surface-mounted Radiant Type with air-cooled housing . . or the Exclusive Heat-A-Ventlite . . combining a Heater plus an Exhaust Fan plus Ceiling Light — to save space.

NuTone Ceiling Heaters have armored elements for longer life and trouble-free performance. Moderate in Cost — Easy to Install.

NEW DELUXE 1960 Catalogs in BINDER

Write to NUTONE, INC., Dept. NA-1, Cincinnati 27, Ohio

Revere Outdoor Lighting makes driving and parking safe and easy at Eastpoint Shopping Center, Baltimore, Md. The well lighted parking lot makes the shopping center look more inviting. Architect: Kenneth C. Miller; Consulting Mechanical Electrical Engineers: Whitman, Requardt & Associates; Electrical Contractor: Harry A. Goldberg Co.; Electric Wholesaler: Graybar Electric Co., Inc.

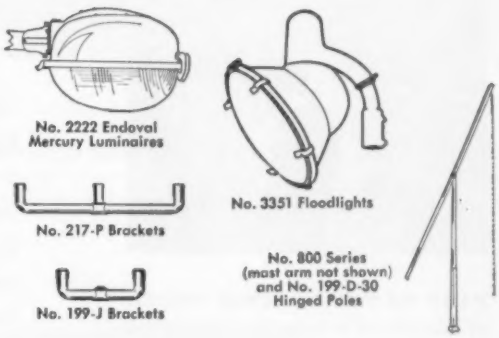
Revere's complete line of matched equipment makes any outdoor lighting job easier

Any outdoor lighting problem is easier to solve with Revere equipment. The wide line, from one source, lets you select the exact combination of fixtures required to do the job best . . . simplifies ordering and assures on-schedule delivery, too.

At Eastpoint Shopping Center (above), Revere Endoval Mercury Luminaires, mounted on Revere hinged poles, illuminate driving lanes. Parking area lighting is provided by Revere floodlights with 400-watt EH-1 mercury lamps. Floodlights are mounted two or three to a Revere hinged pole, with pole spacing 150 ft. Ballasts are in manholes between poles. Average maintained footcandles 1.1.

Installation of equipment at Eastpoint was easier because Revere components are *matched* for strength, balance, and perfect fit . . . and for peak lighting efficiency. Write for a Revere outdoor lighting equipment catalog. The complete, matched line makes solving any outdoor lighting problem easier.

Revere components used to light shopping center


No. 2222 Endoval Mercury Luminaires
No. 3351 Floodlights
No. 217-P Brackets
No. 800 Series (mast arm not shown) and No. 199-D-30 Hinged Poles
No. 199-J Brackets

Revere ELECTRIC MFG. CO.

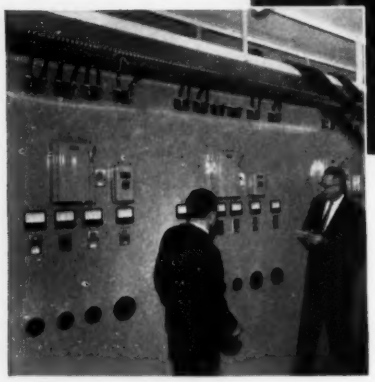
OUTDOOR LIGHTING

Revere Electric Mfg. Co. • 7420 Lehigh Avenue • Chicago 48, Illinois (In suburban Niles)
Long Distance Phone: NIles 7-6060 • Chicago Phone: SPring 4-1200 • Telegrams: WUX Niles
In Canada: Curtis Lighting, Ltd., Leaside, Toronto, Ontario

Blackburn's

New Testing Facilities

give accurate test data for utilities, precise evaluation of design ideas

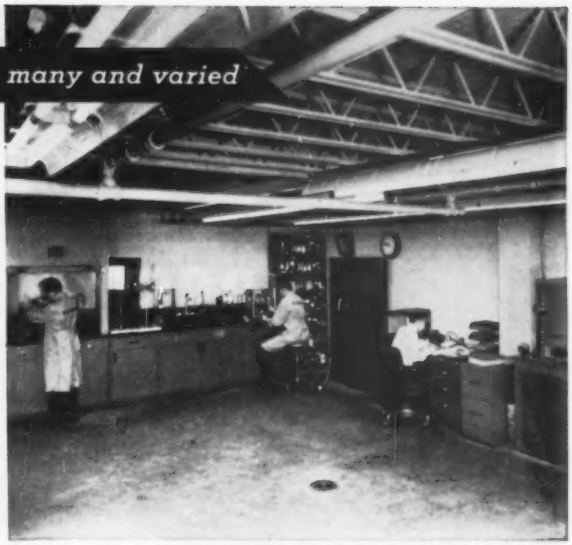


PART OF THE CONTROL PANEL of Blackburn's recently completed current cycling laboratory. John A. Toedtman, Chief Engineer (left), and Ken Way, Vice President, observe tests in progress.

NEW CURRENT CYCLING LABORATORY features virtually draftless air conditioning and a means of closely controlling ambient temperatures throughout the test area. Control of these factors permits truly precision testing of connectors. This photo shows Blackburn laboratory technicians taking resistance and temperature measurements of test connections. These new facilities permit testing of more than 500 connectors simultaneously. Advanced testing facilities like these enable Blackburn to provide you with the proper fitting for every operating condition.

. . . and the tests are many and varied

THE GENERAL LABORATORY, a portion of which is shown here, is the scene of a great variety of tests. Hardness, yield and breaking strength of parts such as castings, bolts, etc., are determined. Special equipment is available for pull-out or holding force evaluation of all fittings. Clamping force measurements giving the relationship between tightening torque and the force exerted by the connector on the conductor are made here. Microscopic examinations and special electrical resistance measurements are routine. Tests like these give Blackburn fittings great dependability.



THE CHEMICAL LABORATORY is the center for tests to control various chemical process solutions used in production. Electroplating, etching, and metal cleaning solutions are regularly tested here. In addition, special surface treatments are evaluated for friction control and corrosion protection. Thus, this laboratory assures continuous control of quality.

SALT FOG CHAMBER, where tests may continue for hundreds or even thousands of hours. Here salt fog tests are made on wire connections. Test conditions are made in accordance with ASTM specifications. Electrical resistance measurements and visual observations are recorded at regular intervals during the tests.

OUTDOOR EXPOSURE RACKS permit long-term exposure tests which often yield valuable information on weathering resistance not accurately obtainable from more highly accelerated tests. Specimens on these racks generally remain on test for at least a ten-year period.

Look to BLACKBURN for *test-engineered* electrical fittings

JASPER BLACKBURN CORPORATION

1525 Woodson Rd. • St. Louis 14, Mo. • WYdown 3-9430

New ORANGEBURG® CA* CONDUIT *with Flush Coupling Attached!*

With no separate couplings to handle or attach on the job, Orangeburg CA lays faster, costs less to install. Each long, light length has a *flush* coupling attached at one end and a standard 2° male taper at the other end, making installation a simple, one-step operation. And, since the coupling *is* attached, there are no coupling cartons to warehouse or carry to the job.

What's more, with the coupling *flush* to the conduit's outside wall, new CA is easy to stack, store and handle. The flush coupling also eliminates "staggered" joints in the trench. And that means real savings in cutting and tooling time.

Like the hundreds of millions of feet of Orangeburg fibre conduit in use since 1893, new CA has self-sealing joints and impermeable walls. Its smooth, 100% fibre raceway adds years to cable life.

New Orangeburg CA is available in 2", 3", 3½", 4", 4½" and 5" sizes. Orangeburg Standard and Nocrete Conduit, with separate sleeve couplings, are available as always. Write Dept. ES-10 for Catalog 52.

ORANGEBURG MANUFACTURING CO.
Orangeburg, New York • Newark, California
Division of The Flintkote Company, Manufacturer of America's Broadest Line of Building Products

FLINTKOTE

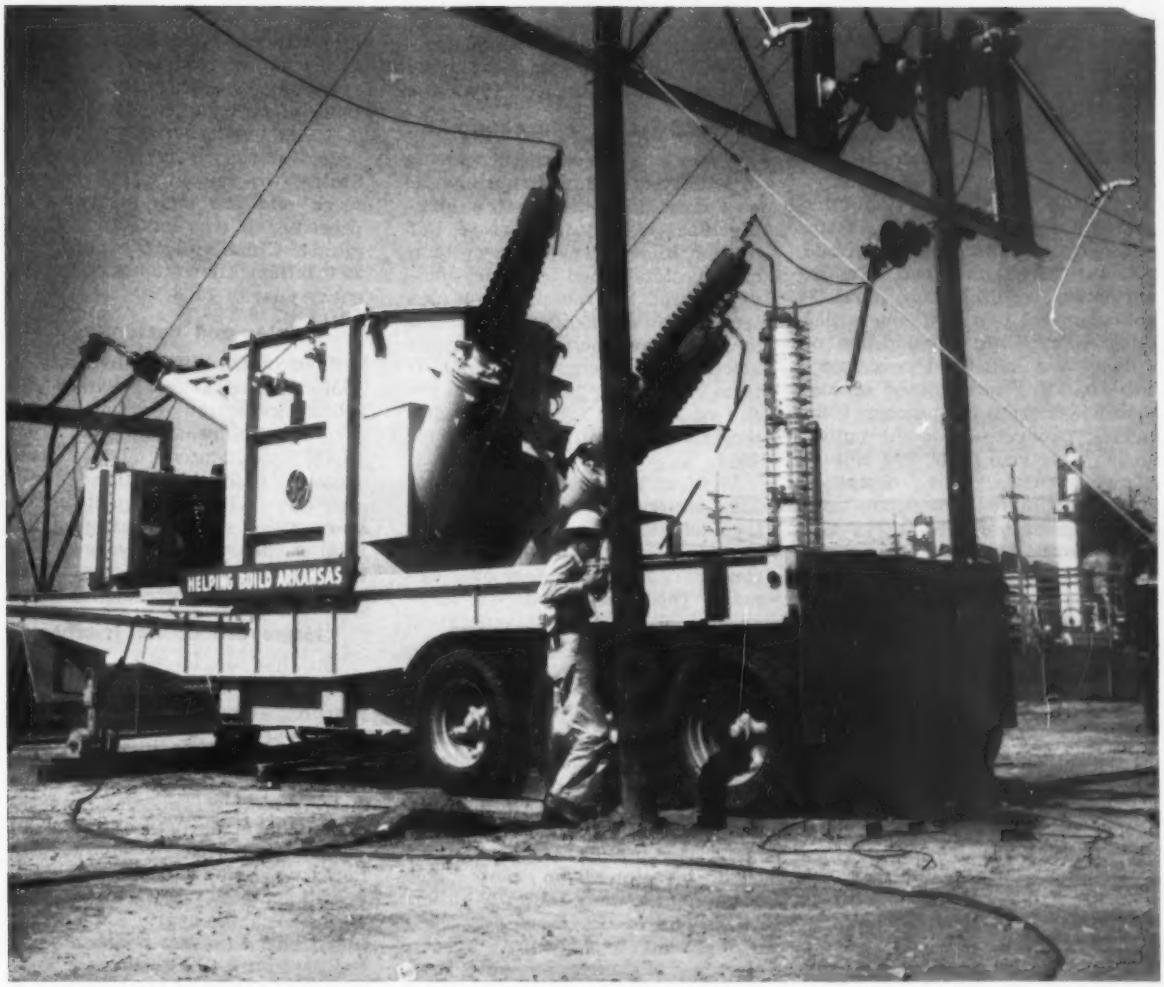
Orangeburg Fibre Conduit is distributed by Graybar Electric Co. and General Electric Supply Co. with branches and stocks in principal cities.

UTILITY ENGINEERING

Transmission — Distribution — Metering

Design
Installation

Testing
Maintenance



Arkansas Power and Light makes effective use of mobile units—see page 48

Industry's performance is credit to engineers—page 44
Feeder conversion with dual voltage transformers—page 46
Engineering sessions cover wide range of problems—page 50
Texas Power Distribution Conference—page 53
Sangamo's capacitor workshop seminar—page 58

Industry's performance record proves credit to engineers

By Allen S. King
President
Edison Electric Institute

◆ CONTINUING to advance in 1959 as the world leader in electric power, the electric utility industry in the United States scored impressive gains in output and a record addition to power capability, despite the prolonged steel strike.

In 1959, preliminary figures show that all components of the electric utility industry generated a record 707 billion kilowatt-hours, an increase of 62 billion kilowatt-hours, or 9.6 per cent, over 1958 production. With the addition of railway and industrial generation, but excluding power used or lost within generating stations, total electric production for the nation during the year was 790 billion kilowatt-hours. This compares with an estimated 1959 production, excluding station use, of 244 billion kilowatt-hours by Russia, the second-ranking nation.

In generating capability, the electric utility industry reached a new high of 165 million kilowatts by the end of the year, a record increase of 15.3 million kilowatts, or 10.3 per cent, over the 1958 figure. The nation's total electric generating capability, including railway and industrial plants, was 183 million kilowatts. It is estimated that Russia had 59 million kilowatts by the end of 1959.

Forecasts for U. S. and Russia

There is no indication that the Russians will be able to catch up with the United States at any time in the foreseeable future. The Russian goal calls for 110 to 112 million kilowatts by 1965. In that year, the United States is expected to have 245 million kilowatts, to lead Russia by more than 130 million kilowatts.

A good indicator of a nation's total productive capacity and the well-being of its people is kilowatt-hour use per capita. For the United States in 1959, this was 4,481 kilowatt-hours, compared with 1,161 kilowatt-hours per capita estimated for the Soviet Union. The Russian goal for 1965 is about 2,100 kilowatt-hours. This compares with a forecast of about 6,000 kilowatt-hours per capita for that year in the United States.

Record increase in capability

There was a record increase in capability of 15.3 million kilowatts on the nation's utility systems during 1959. Of the total increase, 11.8 million kilowatts were on systems of investor-owned electric companies, and the remainder on systems of government agencies. The new additions increased America's electric utility generating capability to 164.8 million kilowatts at the end of 1959, 10.3 per cent higher than the 149.5 million kilowatts for 1958.

With a 1959 peak demand of 129.3 million kilowatts, the industry had 35.5 million kilowatts of reserve capability, or a 27½ per cent margin of capability over demand. The reserve alone was larger than all of the 1958 generating capacity of Great Britain, the third-ranking nation in power supply, and more than two-thirds of Russia's total generating capacity in 1958.

Construction expenditures by the electric companies in 1959 were $3.5 billion, their third largest expenditure on new plant and equipment. This brought the companies' total investment in plant and equipment to more than $46 billion at the end of the year.

For 1960, expenditures by the electric companies for new construction are expected to be about $3.4 billion. About 11.9 million more kilowatts of new generating equipment will be added in 1960—the electric companies installing 9.3 million, and governmental agencies, 2.6 million.

Record week

In attaining new highs in sales and customers, the electric industry established late in December a new record for weekly output of more than 14.5 billion kilowatt-hours, exceeding a record week late in August by only 400 million kilowatt-hours. The 14-billion-kilowatt-hour mark was established for the first time in August, reflecting the increasing importance of air conditioning.

As an indication of the magnitude of power output in the United States, the output of the record week and the near-record week preceding it was more than Communist China's electric output of 27.5 billion kilowatt-hours for the entire year of 1958.

Sales and customers

Sales of the electric industry in 1959 reached a new high of 625 billion kilowatt-hours, and were divided as follows: large industrial, 48.4%; residential, 27.6%; commercial, 17.9%; and other 6.1%.

About 1.3 million customers were added in 1959, bringing the total at the end of the year to 57.5 million. Over 85 per cent of these new customers are residential.

Home use of electricity

The use of electricity in the American home continued its rise, reaching a new high of 3,550 kilowatt-hours as the annual average. This is 184 kilowatt-hours over the previous record in 1958. Residential demand is expected to keep advancing at its present rate, and use of from 6,500 to 7,000 kilowatt-hours per home consumer by 1969 is anticipated.

In Russia, the average home uses about 400 kilowatt-hours a year compared to the 3,550 kilowatt-hours consumed on the average in American homes. A far greater percentage of electric power in Russia is used for industrial purposes than in the United States—about 80 per cent in the Soviet Union, and about 48 per cent in America, but kilowatt-hours used for industrial purposes in the United States are some 70 per cent greater than in Russia.

Gross revenues of the nation's

investor-owned electric companies in 1959 were $9,150 million, 8.2 per cent higher than the previous record of $8,454 million set in the recession year of 1958. Net income was $1,670 million in 1959, 9.0 per cent greater than the 1958 figure of $1,532 million.

$2 billion in taxes paid

The investor - owned electric companies continued as a prime source of tax money, with anticipated payments for 1959 amounting to $2,120 million going to all levels of government, Federal, state and local. This figure is $157 million greater than the tax bill for the preceding year.

As the companies' largest single item of expense, the 1959 tax bill was equivalent to 23.2 cents out of each dollar of gross revenue. Federal taxes took 58 per cent, while state and local accounted for 42 per cent.

The tax figures apply only to the investor-owned electric companies, which serve about 80 per cent of the nation's consumers. Governmental power operations pay no Federal income taxes and in most cases no state or local taxes.

Four out of five of America's electric customers get their power from electric companies — and make substantial contributions to the burden of government through the taxes which must be included in their electric bills. It is gravely ironic, and highly inequitable, that the fifth electricity user—the customer of government-owned or financed power projects—pays nothing like his equitable share of the cost of government through his electric bill.

This inequity is heightened by the fact that the taxes of electric company customers help make possible government spending on more government power projects. And government power projects are being pushed, despite the fact that the investor-owned electric companies have consistently shown through their performance in the past and their planning to meet future needs that there is no necessity for government to be in the power field.

Unnecessary government spending is a widely recognized basic cause of inflation, a problem which is becoming of increasing concern to more and more people as they realize that inflation saps the economic well-being of those who can least afford it. The unnecessary spending going on and projected in the government power field is one area in which a strong blow against inflation could be struck—saving millions of dollars of taxpayers' money for more useful purposes.

Other expense items

For 1959, the electric companies paid out in wages and salaries $1,570 million, an increase of 5 per cent over the 1958 figure of $1,494 million.

Another important expense item was fuel. In 1959, fuel cost the electric companies $1,420 million, a 5.9 per cent increase over 1958.

Comparisons with Russia

Certain government power advocates, recently returned from Russia, have been referring to a few large Soviet hydro projects in a way designed to imply that the United States is falling behind in hydroelectric development. Actually, the United States now has about three times the hydro capacity of Russia. In 1959, hydro production in the U S totaled 152 billion kilowatt - hours — three times an estimated 50.7 billion kilowatt-hours for Russia. Nor do these government power advocates make note of the fact that both countries now have approximately 80 per cent of their facilities in steam and 20 per cent in hydro.

A highly significant omission in their statements is the fact that Premier Khrushchev has announced that the Soviet Union plans a greater emphasis on steam plants in the future. The new capacity expected by 1965 is to be about 85 per cent steam and 15 per cent hydro. The Russians have found, as we have in this country, that, with notable exceptions, electric power can be made more economically from steam.

In nuclear energy also, Russian

(Continued on page 49)

Competing with Russia

Electric power, vital energy of modern civilization, is an important factor in the competition between the United States and Russia. How the electric supply system should be operated is also part of this competition, since it has significant bearing on the form of government under which Americans shall live.

The United States has achieved its position of world leadership in electric power through the growth of the electric utility industry in an atmosphere of free enterprise. This has been so in the eight decades since Edison and a few courageous backers risked their money developing a seemingly fantastic system for electric lighting—the basis for electric power systems throughout the world.

By financing in the free market, the nation's investor-owned electric companies have been able to build an unequaled power supply to meet America's needs. Looking ahead to the future, the companies are fully confident that they can continue to maintain U.S. leadership in electric power under the free enterprise system. But despite the record of accomplishment, there continues to be agitation for more government spending for government power projects.

The problem resolves itself into two questions: Should the power business be financed by individuals and groups free to invest or not to invest in the business, and owned and controlled by the investors operating under government regulation? Or should it be financed by Federal government expenditures and owned or controlled by the government?

If the second way—the way of government ownership and financing—were chosen, a highly significant portion of our economy would then be patterned on the Russian system. Would government ownership of the power business then lead to government ownership of railroads, coal, oil, steel, and other industries?

In the drama of U.S.—Russian competition in the broad economic arena, Americans will have to keep clear in their minds that under the Russian system, government owns or controls all business and the Russian people work for the government. Basically, the issue is *not* that of two great nations struggling for world pre-eminence—it is rather the struggle of two types of civilization. One is based on human liberty, the other on government domination.

If we, as a nation, were to adopt in any field—in the power business or any other—philosophies and practices of government control that are typical of the Russian system, we would destroy the characteristics of freedom and initiative which brought us our world leadership and enables us to keep it. We would then not only lose the competition with Russia, we would lose the human values we sought to save.

Distribution feeder conversion

By J. H. Gantt
Supt. of Distribution
South Carolina Elec. & Gas Co.
Charleston, S. C.

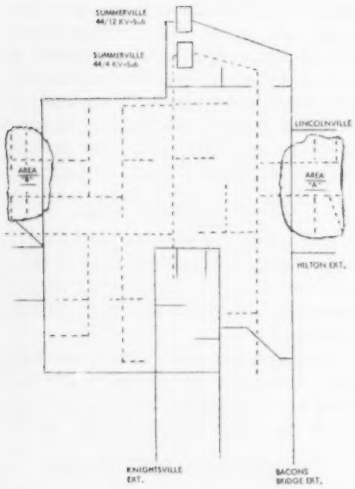


Fig. 1—Simplified one line diagram of 4 kv and 12 kv lines in town of Summerville.

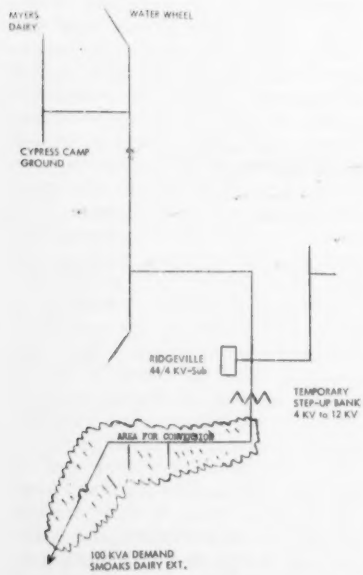


Fig. 2—Simplified diagram of conversion planned for Ridgeville.

◆ DUAL VOLTAGE transformers have become an important item in our conversions to higher distribution voltages to meet the demands of our growing distribution system loads. The impact of air conditioning, electric heating, and the many load building appliances has brought about tremendous load growth on our systems. We all seem to get some of the same answers to the problem of how to serve the predictable load levels of the future. Our answer seems to be in the use of higher distribution primary voltages.

Conversions to this higher voltage must be made economically, with as few line changes, and with as little inconvenience to our customers, as possible. In addition to our primary line changes, one of our major items becomes the distribution transformer changes.

Since this discussion is intended to cover only the transformers we use in conversions to the higher voltage, we will not attempt to cover reinsulating, grounding out, preliminary work, line changes and other work common to all conversions. However, in order to clearly present the problem, it is necessary that we review the voltages of the past on our company system, and their evolution to the present day.

Beginning with 2,400 volts delta some years back, the load growth dictated some changes. Our two divisions, at that time different companies, found their own solutions, one doubling the voltage to 4,800, while the other went to 2,400/4,160 wye. We still have this system in many areas, along with 12 kv and 13 kv levels, since established in both urban and rural areas.

Recognizing the problem to be basically the same for the other voltages, we shall limit this discussion to conversions made from 2.4/4.1 kv to the 7.2/12.47 kv level. It is in this category that the majority of our conversions have been made to date where dual voltage transformers are being utilized. To complete our conversion program, however, we should mention that one area is now converting 4.8 kv to 24.9 kv by using the 4.8x14.4/24.9 kv dual voltage transformer. Another area is converting 2.4/4.1 kv to 7980/13.8 kv wye with 8 kv transformers.

The dual voltage transformer in this latter category is not an even multiple of 2.4 kv, and becomes a "special." Up to now, we're doing this one the hard way, with conventional type transformers. The dual voltage transformers, however, are available at a somewhat higher cost.

Typical conversion program

Many of our areas have both 4 kv wye and 12 kv wye, the latter first coming into the picture with the expansion of our rural program in the 30's. It seemed only natural that as our load grew, we would favor the 12 kv source where it was available. Now, our program is to generally confine the 4 kv to its present load, cutting back as needed, and using the 12 kv source. Our planning in this direction has included providing more 12 kv capacity, new 12 kv sources, and 12 kv loops around the 4 kv. With this arrangement, we are now able to convert to the higher voltage as needed to confine the 4 kv. In many instances, of course, the load is put on the 12 kv in the first place.

A typical town on our system is shown in Figure 1. Areas such as shown encircled ("A" and "B") are typical of areas cut over in the program of confining the 4 kv load. The procedure is to reinsulate the area for 7.2/12.47 kv, working it energized to supply uninterrupted service. At the same time some normal maintenance work may be done to bring the line up to standard, while it is still in the "glove" category. All of the 2,400 volt transformers are replaced with dual voltage transformers rated 2,400 x 7,200/12,470 Y volts. These will operate on 2,400 volts until cutover day.

It should be noted here that these transformers are changed out during normal working hours with no overtime involved. We even go a bit further than this by taking advantage of short periods of time,

with dual voltage transformers

such as between rains, or otherwise wasted short periods of crew time when we may be able to change out one or more transformers. A job finished at 3:45 p.m. often leaves us time to change out a transformer. This may not suit a crew, but it utilizes time that would otherwise be sitdown time.

Normally our conversions come under one of two categories; (1) Areas we expect to convert immediately. This, of course, is an area already served at the lower primary voltage. (2) Areas we do not expect to convert immediately, and plan to keep at the lower voltage for a time.

In category (1) we replace the 2.4 kv transformer with a 2.4x7.2/12.47 kv dual voltage, change the lightning arrester, and, if necessary, change out the cut-out. We use 7.8 kv cutouts for both 2.4/4.1 kv and 7.2/12.47 kv single-phase installations, and often it is not necessary to change the cutout unless it is an old installation where 5.2 kv cutouts are still in use.

In category (2) would come new areas already on or near the 4 kv source, but within areas designated for later conversion in our confinement program as we work the 12 kv into the area. In this case, we build the new distribution for 12 kv and set dual voltage transformers, leaving them on the low voltage tap. The use of 7.8 kv cutouts on both voltages eliminates any further changes on cutouts.

Caution on arresters

If we have a summer between then and the conversion, we prefer not to take a chance on the high voltage arresters. One conversion on another voltage on which we took this chance cost us five transformers.

We often take advantage of slack work periods to prepare for conversion by reinsulating and getting an area ready, although we may not plan the actual cutover for some time. Dual voltage transformers are installed here too, although with money costing us 10 to 15% per year, some might feel that the carrying charges for a year or two offset the saving at the time cut-

Table I—Conversion cost comparison in area for later conversion

	5 kva	10 kva	15 kva	25 kva	37.5 kva
Set 2.4 kv	$ 7.72	$ 13.66	$ 13.66	$ 14.85	$ 20.20
Set 7.2 kv (on back of pole with required temporary rearranging)	12.04	17.82	17.82	20.03	27.16
Reconnection on conversion day	5.00	5.00	5.00	5.00	5.00
Remove 2.4 kv	5.18	7.83	7.83	10.21	13.77
1. Total cost using conventional transformers	29.94	44.31	44.31	50.09	66.13
Cost of 2.4/7.2 kv without taps	130.00	197.00	252.00	347.00	455.00
Cost of 7.2 kv without taps	120.00	183.00	233.00	321.00	421.00
Difference-transformer cost	10.00	14.00	19.00	26.00	34.00
Set 2.4/7.2 kv dual voltage	7.72	13.66	13.66	14.85	20.20
Reconnection on conversion day	2.00	2.00	2.00	2.00	2.00
2. Total cost using dual voltage transformers	19.72	29.66	34.66	42.85	56.20
3. Saving in favor of dual voltage transformers	$ 10.22	$ 14.65	$ 9.65	$ 7.24	$ 9.93

NOTE: Installation costs include incidental wiring, but not cross arms, cutouts, arrestors, grounds or primary risers.

Table II—Conversion cost comparison in area for immediate conversion

	5 kva	10 kva	15 kva	25 kva	37.5 kva
Remove 2.4 kv	5.18	7.83	7.83	10.21	13.77
Set dual voltage 2.4/7.2 kv	7.72	13.66	13.66	14.85	20.20
Reconnection on cutover day	2.00	2.00	2.00	2.00	2.00
Difference in transformer cost (from Table 1)	10.00	14.00	19.00	26.00	34.00
1. Total cost using dual voltage transformers	24.90	37.49	42.49	53.06	69.97
Set 7.2 on back of pole and rearrange as required	12.04	17.82	17.82	20.03	27.16
Reconnection on cutover day	5.00	5.00	5.00	5.00	5.00
Remove 2.4 kv	5.18	7.83	7.83	10.21	13.77
2. Total cost using conventional transformers	22.22	30.65	30.65	35.24	45.93
3. Saving in favor of conventional 7.2 kv	$ 2.68	$ 6.84	$ 11.84	$ 17.82	$ 24.04

NOTE: Installation costs include incidental wiring, but not cross arms, cutouts, arrestors, grounds or primary risers.

over is made. We think the other advantages make it worthwhile.

We have at least two other choices besides the use of dual voltage transformers. The 2,400 volt transformers can be replaced with 7,200 volt transformers on cutover day. This, of course, requires too long an interruption to service, and is not considered at all practicable. We have done none by this method.

Another method which we used up until about three years ago, and still use where we wish to utilize present stock, is to hang the 7,200 volt transformer on the back of the pole from the 2,400 volt, or lower the 2,400 on the pole and install the 7,200. Later, we remove the 2,400 volt transformer and equipment. This latter method requires at least three climbs on separate days.

Now we come back to the dual voltage transformer and the cutover procedure. Our crews usually are broken up into crews of two men each, the number, of course, depending upon the size of the area to be converted. Earlier conversions with conventional transformers found us asking the public for four hour interruptions, and we chose the area we thought we

(Continued on next page)

Mobile unit eliminates power interruptions

◆ THE ARKANSAS Power and Light Company proved the worth of their new "transformer on wheels" recently when it was moved to its first job in El Dorado, Ark.

The new unit, first of its type in the state, was taken to the Monsanto Chemical Plant's substation in El Dorado and set up to provide temporary service while crews of AP&L installed a new 15,000 kilowatt transformer to provide the plant's needed additional electrical capacity for present production and future growth.

The chemical plant, which operates 24 hours a day, was thus able to switch to the larger transformer without a minute's delay in service. The unit was connected "hot" to the plant's substation and handled the power requirements for eight hours while construction crews made last minute adjustments on the new transformer, then used "hot sticks" to switch the 115,000-volt line to the new transformer.

The new stationary transformer installed at the plant will increase the substation's capacity from 10,000 to 15,000 kilowatts and is constructed so that capacity can be increased to 20,000 kilowatts with the addition of an external cooling fan. Capacity can be further increased to 25,000 kilowatts by adding cooling fans and forced oil circulation.

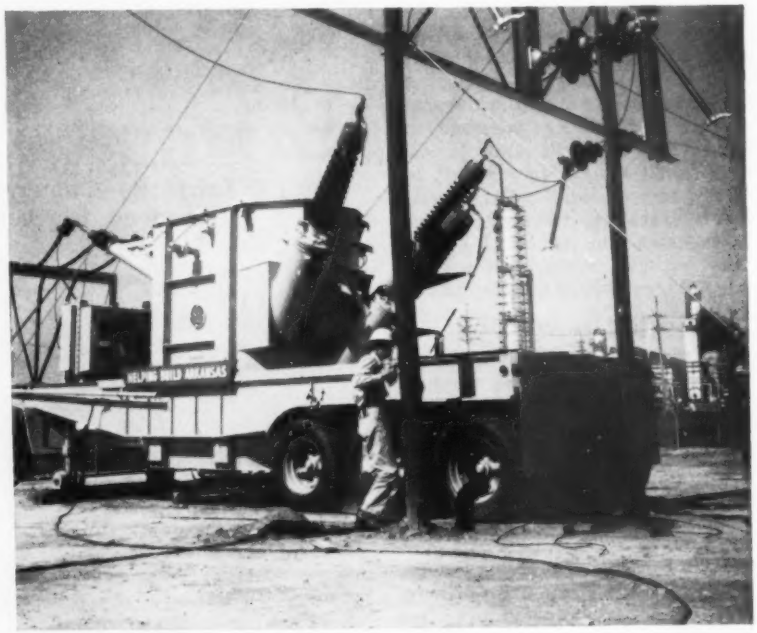
W. C. Alley, division manager for AP&L, said that they had two objectives in mind when they purchased the mobile transformer unit: (1) to provide uninterrupted service while substation maintenance is in progress; (2) to greatly decrease service interruption time when a transformer is damaged in service.

Alley said also that the new mobile unit will prove invaluable in that it can be rushed to any substation on the company's system when it is needed in about a third of the time required to move in a "fixed type" spare unit.

After the job operation at Monsanto Chemical Plant, the unit was moved to Fordyce, Ark., and used to provide service to the city while improvements were made at the Fordyce substation.

The mobile unit is built into a truck trailer for better balance and lowest possible road clearance for rapid movement and can be safely moved along the highway at speeds of fifty miles an hour.

Total weight of the equipment, including 3,000 gallons of cooling oil, is approximately 35 tons. Overall length is 35 feet. It is 13 feet, six inches high and eight feet wide. Cost of the mobile transformer unit was estimated at approximately $65,000.



Arkansas Power and Light Company's new mobile transformer unit is shown on its first job as it is set up at Monsanto Chemical Company's substation in El Dorado, Ark. Use of the mobile unit, first of its kind in the state, made it possible to install a new 15,000 kilowatt transformer at the plant with no interruption of service.

could handle in this time or less.

Recent surveys made by our engineers in the field show a cut from the old four hours to one-and-one-half hours for the equivalent area with the dual voltage. Considering that more often the cutover is made on overtime, this in itself is a sizeable saving in labor, as well as an improvement in our public relations.

Estimates vary, but seem to average 10 minutes per transformer, including travel time, for the two man crew. They need only to climb the pole, turn the handle, change the fuse size, and then proceed to the next transformer. Details of the line work are not included here, but it is worth mentioning that where the 12 kv loop exists along with the 4 kv, we need only to de-energize the feed within the converted area and tap up to the 12 kv at the appropriate time.

Where the substation source is to be changed as well as the distribution, our procedure has been basically the same except that we have made use of step-up transformers in order to complete an area at a time, starting at the far ends and working back to the source. See Figure 2. The step-up bank is moved back towards the source as each area is completed, and finally the last section of feeder, and station, is converted. This method may not be practicable on some systems, but is used very effectively on some of our smaller stations where distance is our problem rather than load. We have several areas partly completed now with the step-up banks in service.

Area for later conversion

Referring to Table 1, we have attempted to make a comparison between costs of making conversions with conventional and dual voltage transformers. Item 1 includes the cost of the original set of the 2.4 kv, removal of the 2.4 kv, set of the 7.2 kv, and reconnection on cutover day. The actual procedure will not follow in this order, since it is necessary to have both transformers on the pole until cutover day.

Item 2 includes setting the dual voltage transformer in original installation, the difference in purchase price of dual voltage and conventional, and reconnection on cutover day. Reconnection in this instance only requires turning the handle and changing fuse.

Item 3 shows the saving in favor of the dual voltage transformers. All labor costs are unit costs which we pay our local line contractor. Using our own crews we like to think it runs somewhat less. Transformer costs shown are June 25, 1959, prices of dual voltage and conventional, without taps, of type and make we are using. I should like to point out again that the labor figures do not include equipment other than the transformers.

Area for immediate conversion

Referring to Table 2, areas for immediate conversion will require either removing the present 2.4 kv transformer and replacing with a dual voltage until cutover day, or installing a 7.2 kv transformer on the pole with the 2.4 until cutover day, later removing the 2.4 kv. Item 1 shows the total cost using the 2.4/7.2 kv dual voltage transformer. Item 2 shows the cost using conventional transformers. Item 3 shows, in this case, a saving in favor of conventional 7.2 kv transformers. The saving here is only a small percentage of the total cost, as is the case in Table 1, where it favors the dual voltage transformer, and we look at it as a "break-even" proposition.

In these areas where customers are already served, we feel that the dual voltage transformer makes the conversion so much easier and simpler that it more than offsets the very small extra cost. If we measured customer relations, lost revenue, and other such items in dollars and cents, we have no doubt that by cutover day the dual voltage transformer would come out well ahead.

Performance record

(Continued from page 45)

experience and planning are similar to our own. Soviet scientists have said that their atomic power program is still in the research and development stage, as it is in the United States. Costs of producing power from atomic fuels in each country are above the costs from conventional fuels.

The size of the atomic development program in the United States is considerably larger than in Russia. By the end of 1959, a little over five years since the passage of the 1954 Atomic Energy Act (which permitted industry for the first time to engage in development and construction of its own atomic plants), a total of 131 electric power companies and associated service organizations were participating in projects for the development and construction of atomic power plants and major research, development and study projects.

Electric power companies are participating in 16 plants which will have a combined capacity of about 1,400,000 kilowatts and will require an estimated expenditure by the companies of more than $570 million.

Three of the plants are already in operation. Three more are scheduled to come into operation in 1960, bringing the total of nuclear-fueled power capacity to about 490,000 kilowatts by the end of the year.

This compares with the Russian program under which five atomic power plants of a total of 465,000 kilowatts are built or are under construction.

Value of electric service

Inflation continued as one of the nation's most serious problems, and this was reflected in the Consumers' Price Index, which moved to a new high of 125.5 in October, 1959 (1947-49 = 100). In contrast, the average revenue per kilowatt-hour sold to home consumers maintained its steady decline. In 1959, average revenue was 2.51 cents, down from 2.53 cents in the previous year.

Electricity's place in the family budget is very small, despite the many services it performs and the steadily increasing quantities being used.

Some predictions for 1960

Looking ahead to the next twelve months, the electric industry is planning and working towards establishment of new records in generating capability, production, sales and revenues.

By the end of 1960, the total generating capability of the electric industry is expected to be advanced 7.2 per cent over 1959, to reach 176.7 million kilowatts. Electricity production is expected to be 7.7 per cent higher than the preceding year, with 1960 generation totaling 761 billion kilowatt-hours. Sales by all parts of the industry will advance 8.0 per cent to a new peak of 675 billion kilowatt-hours. Customers will reach a total of 58.7 million. The revenues of the investor-owned electric companies should be about 7 per cent greater than in the preceding year, totaling about $9.8 billion for 1960.

Southern engineering sessions

◆ PRACTICALLY every phase of distribution and transmission engineering and operation received some consideration and discussion in the several fall meetings held in the South and Southwest. Several hundred utility company engineers and executives and a large number of electrical equipment manufacturers' representatives were in attendance at the Engineering and Operation Section Conference of the Southeastern Electric Exchange, held in Atlanta, Ga., and the Texas Power Distribution Conference, held in Austin, Texas, under the sponsorship of the Electrical Engineering Department of the University of Texas.

More specialized but nonetheless interesting to distribution engineers was the seminar held in Greenville, S. C., under the sponsorship of Sangamo Electric Co., on the subject of "Measurement and Control in the Application of Power Capacitors." This meeting included participants from some forty electric light and power systems throughout the country, including a substantial number from the South.

Capacitors discussed extensively at Exchange engineering conference

Several papers presented at the fall meeting of the Southeastern Electric Exchange's Engineering and Operation Section discussed application of capacitors to distribution and transmission systems. One of these, a discussion of the experimental use of capacitors for reducing voltage surges in substations, presented by Herman B. Wolf, manager of operations, Duke Power Co., was published in complete form in the December 1959 issue of ELECTRICAL SOUTH.

The use of a series capacitor bank to improve parallel operation of large and small conductor lines was discussed by H. L. Deloney, assistant chief engineer, and Jack Davey, electrical engineer, of Louisiana Power and Light Co.

The authors pointed out that "growing utility systems which are requiring movement of larger blocks of power between generating areas are calling for larger and larger conductor sizes and higher voltages. Series capacitors can be the most attractive answer to many interim and permanent transmission problems.

"In the case of the Bogalusa bank we were able to double the effective loading on a $3,000,000 transmission line by the expenditure of only $500,000 for a series capacitor installation. The additional transfer capacity gained by the installation of the series capacitor cost about $10 per kw, whereas the average cost of transmission throughout the company is $50 per kw.

"We feel that high voltage series capacitors offer one of the best methods available for controlling load division between parallel lines of widely differing conductivity. Each application, of course, will have to be engineered and evaluated on its own merits. Series capacitor banks cannot yet be ordered by catalog numbers."

Voltage control

Another presentation on capacitors compared them to regulators for voltage control. Presented by J. K. Dillard, manager, and R. F. Cook, distribution engineer, both of General Electric Company's Electric Utility Engineering Dept., this paper considered four different combinations of equipment: (1) regulators alone; (2) fixed capacitors and regulators; (3) fixed capacitors, switched capacitors, and regulators; and (4) fixed and switched capacitors.

The authors pointed out that results of this study should be considered only as a guide in setting up general policy regarding primary feeder voltage control. Individual feeder characteristics vary so widely that it is virtually impossible to show a "typical" feeder. In order to determine the precise relative economics of various methods of voltage control for any given feeder, it would be necessary to repeat this study for that feeder. However the relative results of this study are in general agreement with a large percentage of the actual feeders that have been studied by the authors.

This entire study was performed on an IBM-704 digital computer using a primary-feeder voltage control program. Use of this program begins with the listing of primary-feeder circuit line impedance and kva-load and power factor information on standardized data sheets. Also listed are line voltage requirements and equipment and system costs. This is the same information required to analyze primary-feeder votlage and design conditions by longhand calculating methods. The information on the data sheets is punched on cards and then may be read onto magnetic tape to improve efficiency of computer use if there are many feeders to be studied. The input data, either on cards or tape, and the computer program which is on tape are loaded into the IBM-704 computer where the calculations take place.

Two feeder models were studied; one operating at 7.200 volts line to ground and the other at 2,400 volts line to ground. For each feeder model, 44 combinations of equipment were studied at heavy load and the most economical of each of the four types of solutions were selected.

The authors reported that conclusions drawn from the results of studying these simple radial feeder models can be applied to more complex radial feeders with many lateral branches by considering that these more complex feeders are simply a number of simple feeders tied together. However for an actual feeder problem where exact rather than relative results are desired, the computer program will consider a main line with up to 15 single or three-phase lateral branches.

The results of this study, they

cover wide range of problems

said, show that at 7,200 volts to ground, voltage regulation by means of fixed and switched capacitors and regulators is most economical from a total cost standpoint. At 2,400 volts to ground, fixed and switched capacitors are most economical. The study spotlights the fact that as feeder voltages and kva loadings increase, regulators become more attractive because of their substantial cost decrease in dollars per kva.

Portable transformers

Considerable interest was evidenced in the talk made by G. T. Finger, distribution engineer for Duke Power Co., Charlotte, N. C., describing their experience with portable distribution transformers. Mr. Finger pointed out that they were using the portable transformers in two particular types of situations (1) to maintain service in the case of failure of larger transformers where replacement and maintenance crew may not be immediately available, and (2) to maintain service in the case of planned service interruptions where transformer must be changed out for overload, relocation, repair, voltage change, etc.

A portable distribution transformer, Mr. Finger explained, is merely a standard pole type unit mounted on wheels with a metal hood to cover the top portion of the transformer and to house the wire reels and cover the H.V. and L.V. terminals.

The Duke Power Company has developed two new models of 2-wheel portable distribution transformers and has eleven of these units already in operation and four more in process of manufacture.

One unit is 100 kva single-phase rated 2,400 x 7,200 - 120/240 volts with dual primary voltage adjustable by means of an external dial switch to change from 2,400 to 7,200 volts. The unit is of the CSP type. The secondary breaker is used to assist in load transfer.

The other unit is 150 kva three-phase rated 4,180 x 12,540 - 216-Y/125 volts dual primary voltage adjustable by means of an external dial switch to change from 4,180 volts to 12,540 volts. The unit is also of the CSP type, and the secondary breaker is used to assist in load transfer.

Secondary cables on these units are unique, consisting of 5,341 strand size 4/0 welders cable wound on independent non-magnetic reels mounted just above the secondary terminals of the transformer. A metal hood is provided on both the single-phase and three-phase models to cover the top portion of the transformers, to house the cable reels, and shield the H.V. and L.V. terminals for safety.

These portable transformers are rather unique in design in that a single front wheel with tricycle landing gear is provided so that the unit can be rolled around by two men. At the rear of the transformer a rear deck is provided which serves a dual purpose, to provide a platform for a man to stand on when connecting the low voltage cables and to provide an outrigger to prevent the unit from turning over backward.

The high voltage leads are stored in the hood and are available by opening the counterweighted hood cover. Counterweights are provided on the hood cover for safety to prevent slamming of hood cover which might injure a man's hand or fingers.

"We think the new portable transformers, as developed by the Duke Power Company, have many new and improved features which make them worthy of being considered as a much needed new tool to be used in maintaining electric service," Mr. Finger said.

"The portable transformers were delivered to us on April 15, 1959, and have already reduced service interruptions in cases of both transformer failure and transformer change outs. In one case the unit was left in service four days due to an emergency elsewhere that occurred just after the unit was put in service at location. In another case the unit was put in service to supply service while transformers on a 2 pole bent were changed out. We are using the portable transformers mostly for change outs and in so doing our crews are becoming experienced and can do a quick job when connecting the transformer for transformer failure or other emergency."

R. C. Webb, operations superintendent for Florida Power and Light Co., directed attention to the fact that in using storage reels for connecting leads for equipment such as the portable transformers, the lead either must be completely unwound from the storage reels or the carrying capacity of the cable must be reduced according to the number of layers of cable remaining on the reel. For example, he said, three layers of cable on the reel will reduce the carrying capacity to 45% of its original value.

Revenue metering

In a comprehensive discussion of metering, A. L. Carvill, of the General Electric Co., discussed the quality that has been built into modern meters despite the fact that meter prices have been kept down in the face of rising costs. Simplified designs, new manufacturing techniques, and investments in automation and improvements in manufacturing efficiency have all played an important part, he said.

One of the problems facing the electric utility industry, he said, is what to do about the millions of older meters that are still in service. A recently conducted survey indicates that some 15 million meters, that is about 30 per cent of those in service, are inadequate for average residential loads experienced today, and another 11 million or 22 per cent are in the doubtful category.

"Why do meters become obsolete?" he asked. "The principal cause is lack of capacity, either thermal or for accurate measurement. Another important factor is that older designs require extra costs in testing and maintenance to assure continuance of the desired degree of accuracy performance.

"Considering the economics involved, the cost of keeping a meter in service should include the revenue loss due to inaccuracies and overloads, the excess cost of testing and maintenance, and the cost of rebuilding the old meter to in-

crease its capacity or modernize its construction. In considering the cost of retiring a meter, evaluation should be made of the cost of the new meter, the rate of interest to be earned on this investment, the probable life of the new meter and the probable remaining life of the old meter."

Mr. Carvill reported that the utility industry has recently developed an active interest in statistical sample testing of service meters to obtain better control of testing and maintenance costs and to ultimately make large scale reductions in these costs.

By application of recognized statistical sampling procedures, it is possible to predict the accuracy of the total group of meters from test data secured on a small number of samples. This prediction can be made with a high degree of assurance.

Statistical sample testing provides data to show the performance of meters by the stratifications selected, such as by age, type, location, etc. Savings can result through proper interpretation of these data to direct testing, maintenance or replacement efforts to only those groups of meters requiring attention. When the total quality of the entire meter plant reaches satisfactory levels, the cost to maintain satisfactory metering will be small.

Several state regulatory commissions have already granted permission for the adoption of some form of selective testing. In one instance, the number of meters of the various types to be tested each year is determined by the results of sample tests made on these same groups the previous year.

Savings in meter testing

Some of the larger utilities have estimated that selective testing will make available immediate annual savings of from $70,000 to $700,000 that can be used for directed maintenance or retirement. Variables in these estimates depend on the number and condition of meters in service, the selective test plan chosen, the testing cost per meter, and the previous periodic test schedule against which the comparison was made.

A number of utilities have for several years been applying statistical sampling plans to new meters as received from the manufacturer. Samples are selected and tested to judge the quality of the complete shipment. Sample testing of service meters is but a logical extension of these accepted practices.

If determination of the accuracy of large groups of meters is to be predicated on results of tests on a limited number of samples, it is imperative that this testing be of a high order. The standard watt-hour should be maintained as close to 100% as practicable. The watthour standard used for testing and the test equipment itself should be capable of good repeatability.

Instrument transformers

J. E. Burney, supt. of meters, Alabama Power Co., in discussing Mr. Carvill's comment, pointed out that instrument transformers are very much a part of metering, and that the recently developed doughnut transformers have reduced installation costs materially.

"Low voltage current transformers have truly been a boon to good metering practices," Mr. Burney said, "but we still have need for a small compact potential transformer for use with our 480 volt metering."

Line maintenance

Practically every phase of distribution line maintenance procedure was covered in a comprehensive paper presented by Robert L. Ware, of Virginia Electric and Power Co. Right-of-way maintenance as well as substation and equipment maintenance was covered. Of particular interest to many distribution engineers present were Mr. Ware's comment on conductor maintenance.

"In the mid-forties," he reported, "we began the widespread use of aluminum conductors on distribution circuits, and except in rare instances, we now only use copper conductors in our coastal areas close to the ocean or salt bays. I am sure our experience parallels the experience of many of the operating companies who began to use aluminum for distribution without proper evaluation of the effects of oxidation, corrosion, and galvanic action in the many thousands of connections required on distribution circuits in connecting aluminum to aluminum and aluminum to copper.

"During our first ten years' experience with aluminum, we used compression full-tension splices on conductors larger than #1/0 ACSR, and twist sleeves on smaller conductors, but most of the other connections were made with bolted connectors. The use of inhibitors was messy and when overtorqued bolts in connectors broke, the usual tendency was to undertorque the bolts. We realized that corrosion problems existed, and we experimented with various inhibitors, and purchased torque wrenches to assure uniform connections.

"In the latter part of 1956, and in 1957, we began to experience an unusually high rate of failures in connections, not only in aluminum to aluminum, and aluminum to copper, but also in copper to copper connections. When we examined many of these failures, we found serious evidences of internal arcing, burning, and large build-ups of conductor oxides. There were also many burndowns of lines caused by hot line clamps, which had been frequently used to connect tap lines, and sometimes used as opening points in feeders.

"Due to these failures, we began a rather thorough study of compression connectors and tools available, and finally in the middle of 1958, we were completely tooled up with compression tools on our entire system. Each line truck has a hydraulic compression tool, with hot stick extensions for use above 6 kv, and several hand compression tools. Each serviceman has one hand compression tool, and the service sections have a hydraulic tool available for large connections.

Training demonstrations

"In order to teach our foremen, linemen, and servicemen the importance of conductor cleaning, use of inhibitor, tool adjustment, and proper selection of dies, we built several test sets to show the temperature difference between a good and a poor connection. We used old 500:5 ampere current transformers, energized on the secondary side at 120 volts through a Variac, and on the primary side connected loops of conductor with good and poor compression connections. When the loop is energized and rated current passed through the connections, the poorly made ones will heat up much faster than good connections.

"Then we began the actual replacement of all bolted connections on our sub-transmission circuits and heavy 15 kv feeders. Crews were divided into two-man teams and were supplied with 150°F Tempil-stiks, a heat-graduated crayon, to test other bolted connections on the poles being reworked. The crayon will not mark or melt below 150°F and compari-

son tests are made on the connection and on the conductor a foot or two from the connection. If both indicate 150°F heat, 185°F crayons are then used.

"We also removed all hot line clamps directly attached to conductors by using stirrups affixed with compression connectors. We have limited the use of hot line clamps to transformer and arrester connections and recloser installations on small conductor lines. Larger reclosers are connected through blade disconnects, while line taps are either fused, connected through switches, or connected solid.

From records before and after our start in eliminating bolted connectors, we know that we have materially reduced line outages. After the main circuits are completely reworked, we feel that the problem will continue, to a lesser degree, until we have eliminated faulty connections. The many connections, particularly the aluminum service to copper customer entrance connections, continue to worry us. We find that the majority of these connections fail in the service neutral conductors, the one place where a failure can do the most damage to customer utilization equipment. This is a problem that needs much study in our industry, and we have asked several of the suppliers of compression connectors to investigate it. We think it may be caused by lack of current in the neutral, allowing heavy build-ups of aluminum oxide.

"One final word of caution is appropriate at this point. We do not think that compression connections are the final answer to good connections. They are merely the best method at present, due chiefly to the fact that the compression connector is inhibitor-filled, and the tool, in good adjustment, makes a uniform compression. These factors remove much of the human error inherent in a bolted connector. However, the problems of conductor cleaning, tool adjustment, and selection of the proper connector and die are still present."

Relay application

Successful application of underfrequency relays as a means of shedding load when a large block of generation is accidentally lost was reported by E. J. McDougall, system operator, Florida Power and Light Co., Miami. The first such installations were made in 1957 and operating experience gained since that time has been satisfactory.

"We feel that by automatically shedding load in proportion to the loss of generating or transmission facilities," Mr. McDougall told the conference, "we actually prevent the loss of remaining facilities and are able to more quickly restore service to our customers."

Mr. McDougall said that the underfrequency relays had proved to be reliable and to require very little maintenance. He offered the following special comment as a guide to their application for load shedding purposes:

Relays should be connected to a potential source which is located on the same bus as the breakers that are to be tripped if correct operation is to be assured.

Much of the load to be dropped is at tapped substations, and it was in several of these substations that the first installations were made. The first time that the transmission line on which these substations were located tripped, the underfrequency relays also operated, causing unnecessary outages. Examination disclosed that the six-cycle time delay of the underfrequency relays was not sufficient to override the decay of voltage and frequency which existed on the line after the line terminals opened. Oscillograms were taken on the lines judged to have the slowest rate of voltage decay, and it was determined that 0.35 seconds would be an adequate time delay in most cases. Adjustments were made to provide this additional time delay which eliminated these undesirable actions.

If heavy industrial load is added to a transmission line and there are stations on this line which contain underfrequency relays, voltage decay after a line operation should be rechecked.

Use of underfrequency relays to separate power plants which furnish heavy essential load at generated voltage requires extremely careful examination of the application.

Periodic review of feeder assignment is necessary in order to meet changing operating conditions.

To aid in rapid restoration of service following underfrequency relay actions, accurate records of feeder and frequency assignments are kept by dispatchers. This allows prompt dispatching of switchmen to affected substations without waiting for trouble calls to disclose the pattern of interruptions.

Standardization of equipment is helpful in personnel training for both maintenance and operation.

Adequate and continuous training of all personnel in load restoration is essential.

An occasional misoperation (operation or failure of operation of an underfrequency relay) may result from other reasons, such as personnel errors and omissions and mechanical or electrical failures. If the principal reason for having underfrequency relays is kept in mind, the misoperation usually is not considered too serious.

Voltage regulation featured topic at Texas distribution conference

◆ A PANEL DISCUSSION covering several different phases of voltage regulation proved to be one of the outstanding features of the 12th annual power distribution conference sponsored by the Electrical Engineering Dept., of the University of Texas, under the direction of Prof. B. N. Gafford. Held in Austin, Texas, at the University, the conference each year attracts several hundred electric utility and industrial engineering executives and representatives of the electrical equipment manufacturers.

Participants in the panel discussion on voltage regulation included Henry Ford, of City Public Service Board, San Antonio; J. A. Hutchison, West Texas Utilities Co., Abilene; and A. R. Milliken, Electrical Utilities Co., LaSalle, Ill.

Discussing the voltage regulation methods applicable to a metropolitan area, Mr. Ford described the systems in use in San Antonio at the present time. The older substations had an unregulated bus with three single-phase induction type regulators on each circuit. The residential circuits were set up with a different load center for each phase and the circuits were laid out in three areas of approximately equal loads. The single-phase regulators were adjusted to hold the desired voltage at the first transformer in its respective area. This method held a

higher average single-phase voltage throughout the circuit than would have otherwise been possible.

However, as three-phase loads developed on most all circuits and new substations were installed with three-phase automatic tap changing transformers, a change in circuit layout had to be made. The load on all three phases was balanced as uniformly as possible throughout the circuit, and this provided better balanced voltages for three-phase motors on the circuit.

Several years ago, Mr. Ford said, a program of conversion from 4,160 to 13,800 volts four-wire Y was begun and advanced at a rapid rate to keep ahead of load increases on the 4,160 volt system. The substations serving this system generally consist of transformers with automatic tap changers, but some of them utilize an unregulated bus with three-phase step type regulators on each circuit.

An important part of the system's voltage regulation needs is met by capacitors. The total capacity connected now includes 15,300 kva on secondaries; 46,800 kva on primary distribution; and 54,900 kva installed in substations. About one fifth of the secondary capacity is switched by means of thermostats. These capacitors are on most of the summer and off most of the winter, with switching off and on during the in-between seasons. 133 primary system capacitor banks are switched, most of these by time clocks. A few are being operated with a thermostate to override the time clock and keep the bank off during the winter. One 900 kva bank is operated by a reactive relay.

Mr. Ford said in conclusion that the combination of regulators and tap changing transformers at the substation with fixed and switched capacitors on the distribution circuits had resulted in good voltage level from the first to the last transformer.

Low density areas

The aspects of voltage regulation in low load density areas was discussed by John Hutchison, assistant superintendent of engineering for West Texas Utilities Co., Abilene, Texas. He expressed the viewpoint that regulators are needed for regulation, and that capacitors should be used to release generating, transmission, substation, and distribution capacity and should therefore be placed near reactive loads. In low density areas, however, a large part of the capacitor installations should be in substations.

Mr. Hutchison said, "I have checked with our transmission and substation people as well as the distribution personnel in the eight districts, and I have yet to find anyone who thought switched capacitors were very good for voltage regulation, and yet a number of them thought the best way to switch capacitors is with some type of voltage related control."

He continued, "I think on our system as many shunt capacitors should be applied fixed as is practical, as many time-switched capacitors as is practical, supplemented with temperature controlled banks. Also numerous voltage and voltage-and-temperature controlled banks where the conditions exist to warrant their use, that is where the load may change suddenly and does not necessarily repeat from day to day, where large loads are located comparatively long distances from the substation, and where the voltage regulation is not too good for the voltage controls to work effectively.

"This is about what we have now except that I think more fixed capacitors could be added on 12,500 volt systems, some of our voltage controls could be changed to time switch control, and more switched capacitors with various types of control could be added and no doubt will.

"In the near future, we may need to make some provision to enable the system dispatcher to more readily call on or off a number of large banks of capacitors. No doubt, too, more voltage regulators will be added on the 12,500 volt distribution systems in substations as a result of conversions, increased load, and the need in substations without regulators."

Series capacitors

Several years ago, A. R. Milliken, when he was associated with the Public Service Company of Oklahoma, presented a paper before the Texas Power Distribution Conference on the use of series capacitors in conjunction with distribution transformers as a means of counteracting voltage drop.

Mr. Milliken, now associated with Electrical Utilities Co., of LaSalle, Ill., has recently made an extensive survey of the extent to which this application of capacitors is being used by other companies and of their experiences and conclusions. His survey disclosed that some 26 utility companies were using the application either regularly or on an experimental basis.

Some of Mr. Milliken's conclusions based on the survey results are as follows:

"In the large majority of cases series capacitors have proved their value in solving voltage problems. In the cases in which this did not occur it appears the compensation may not have been great enough or that the load power factor was not favorable for the application.

Resonance problems

"That problems have been encountered with resonant conditions, principally ferroresonance and subsynchronous resonance, there can be no doubt. It is worthy of notice, however, that some users have not had any resonant problems.

"Of those who have had resonant problems the majority have not eliminated the practice but are working at eliminating the possibility of resonance. One company in particular has done much experimental work with damping resistors for the particular combinations which it expects to use and has compiled tables showing the resistor to be used with each combination of transformer and series capacitor. This same company expects to make public its findings in the near future.

"Another approach to the problem of resonance is to use a protector which incorporates the effect of a damping resistor in its design. The writer's company has made such an item available.

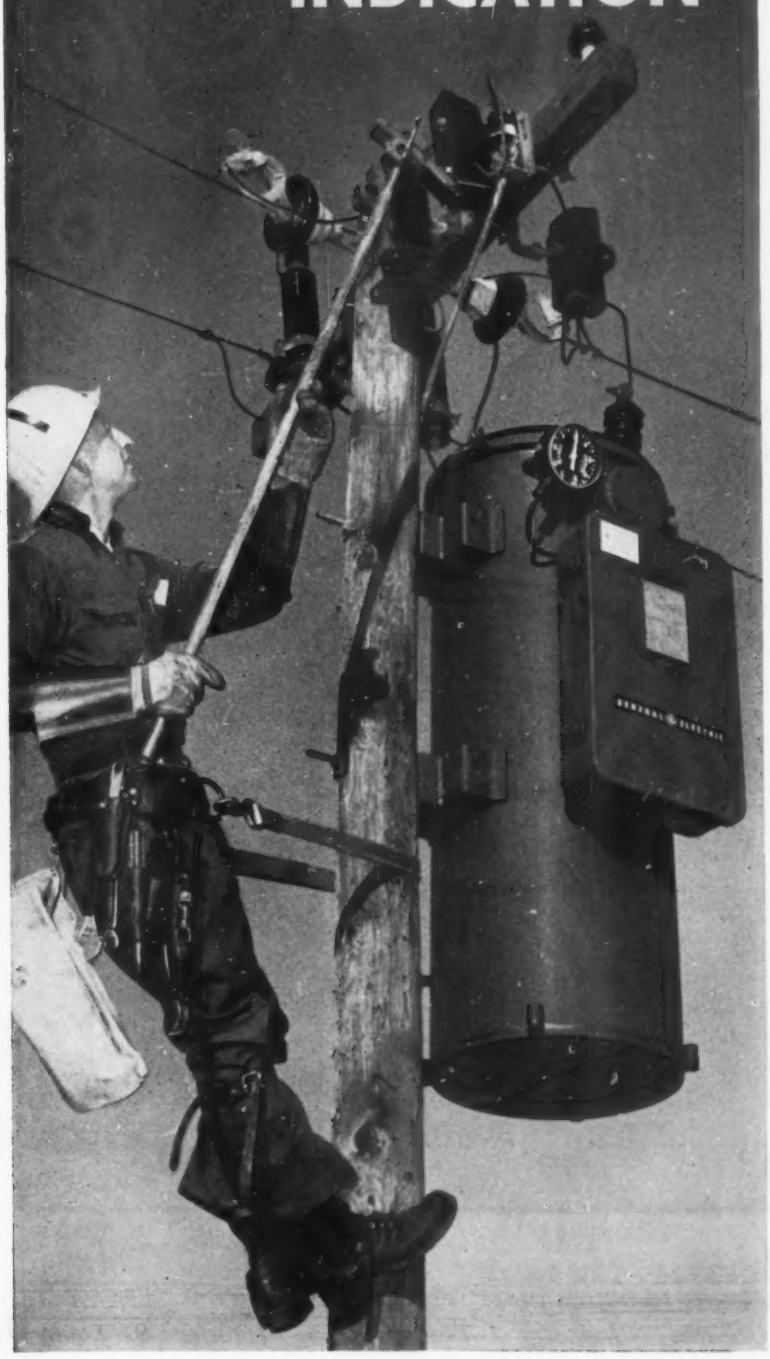
"The economics of series capacitor use is, in the writer's opinion, somewhat clouded at the present time. A bare majority felt series capacitors with distribution transformers should not be considered in distribution planning and also that they would find it difficult to provide economic justification for their use. In the absence of detailed information it can be assumed, since the large majority reported that series capacitors accomplished their purpose in specific cases, that they are considered more costly than possible alternatives or that conditions which are favorable to their use are not general on a system-wide basis.

"The cost of series capacitors can be reduced by using the

(Continued on page 58)

ANOTHER STEP AHEAD IN VOLTAGE REGULATION

POSITIVE NEUTRAL INDICATION



NEW

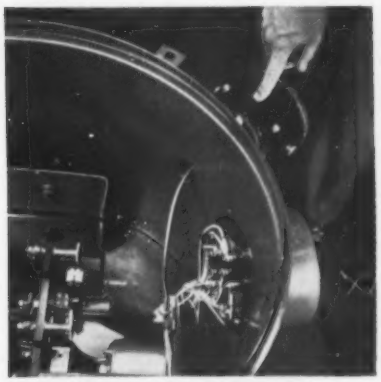
Mark-II position indicator for G-E voltage regulators protects lineman and equipment

Exclusive Mark-II Load Bonus position indicator and indicator drive system for General Electric single-phase step voltage regulators provide positive indication of tap-switch position. This gives more assurance against fear of injury to personnel or equipment when bypassing regulators on hot lines.

Linemen are aware that if a regulator is bypassed with the tap-switch off neutral position, the dead short created across part of the series winding can destroy equipment and seriously endanger the lineman.

It is important that operating personnel *know* that regulators are in the neutral position before bypassing. The new General Electric Mark-II Load Bonus position indicator provides this assurance.

New Mark-II position indicator system—standard on all G-E ML-32 regulators at no price premium—is an example of General Electric's continuing leadership in voltage regulators. This is another reason why G-E regulators cost less on the line. Ask your regulator representative for more information. General Electric Company, Schenectady 5, New York. 423-43



NEW MARK-II INDICATOR drive system eliminates possibility of indication error. Unique locking coupling and gear-driven indicator assure positive alignment of indicator hand and tap-switch position.

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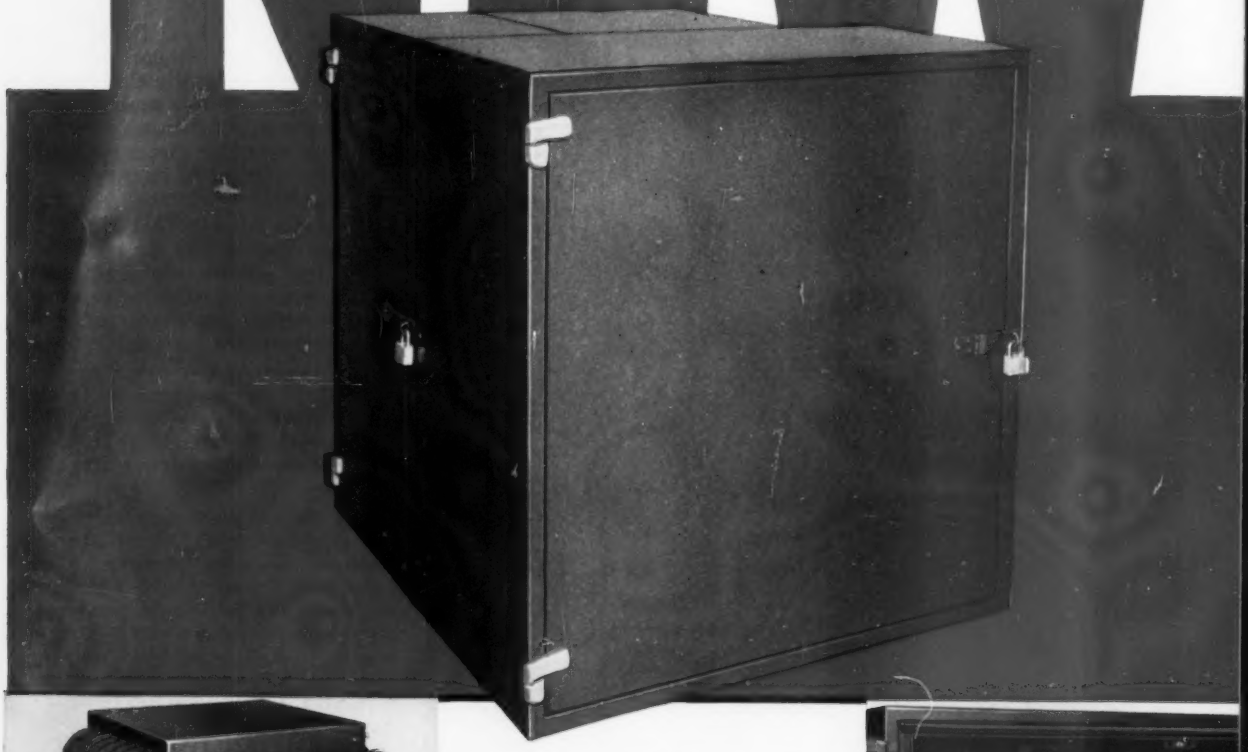


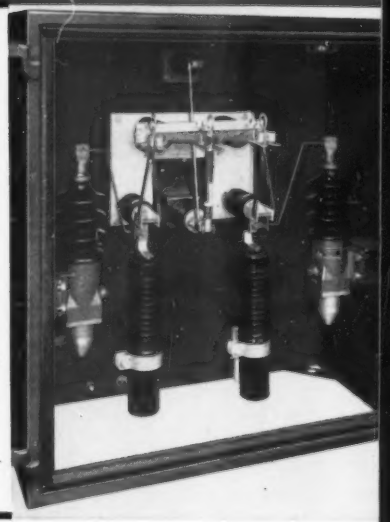
TRANSFORMATION

To provide superior performance under all operating conditions, the transformer portion of the "Unitran" has low exciting current, low impedance and high short circuit strength.

The transformer tank couples with the HV and LV compartments in such a manner that all accessories are inside the compartments.

"Unitrans" are available in voltages thru 15 KV Grd. Y, in conventional types 15 thru 167 KVA and CSP types 15 thru 50 KVA.

To provide interchangeability, a single set of compartments accommodates all sizes of transformers.



Manufacturers: Transformers for Utilities • Industry • Electronics • Factories: St. Louis 20,

MOLONEY "UNITRAN"* FOR UNDERGROUND DISTRIBUTION

PROVIDES . . . APPEARANCE, PERFORMANCE, SAFETY

The Moloney "Unitran" is a new development designed to provide a complete, compact package of transformation, protection and sectionalizing equipment for residential underground distribution systems.

The "Unitran" is a tri-component unit . . . (1) transformer, (2) LV compartment, (3) HV compartment. The basic design emphasizes performance, safety and appearance, thereby making the unit compatible with modern underground systems.

The attractive appearance of the "Unitran" provides an answer to the utilities problem of electric power distribution without overhead lines. Several exclusive features insure safety of utility personnel during installation and maintenance and eliminate the possibility of damage and hazards due to unauthorized entry. The "Unitran" has the same core-and-coil assembly as Moloney Pole Type Transformers; and thus, the same exclusive operating features and superior performance.

*Trademark

Another new item developed for underground systems is the Moloney Transformer Enclosure which provides attractive appearance and safety for standard pole type transformers. Easily assembled, the enclosure is available in sizes large enough to accommodate pole type transformers up thru 167 KVA, 15 KV.

For additional information on either the "Unitran" or the enclosure, request Bulletin #360.

H. V. COMPARTMENT

This compartment has been designed to accommodate lightning arresters, potheads or conduit, and may be provided with a fused-disconnect-and-sectionalizing switch.

This switch, which is designed for loop feeder service, can be operated under load without an external arc by using a commercially available load break tool. Thus, the switch provides for transformer protection and isolation. Other advantages of this external switch include positive visual indication, ease and speed of operation, ease of fuse replacement, and elimination of oil contamination.

L. V. COMPARTMENT

The compartments are fabricated of heavy guage sheet steel and have full width doors equipped with provisions for locking, and designed to be weatherproof and tamperproof. The door hinges are designed to permit the door to be removed quickly and easily.

The LV compartment bolts to the transformer and to the HV compartment and the walls of the compartments isolate live parts of the LV from the HV. Sufficient space is provided in the LV compartment for secondary connections and conduit.

ME59-11

MOLONEY ELECTRIC COMPANY

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largest value of compensation which is practicable from the standpoint of capacitor loading and light load voltage requirements. It should be recognized in this connection that the duty cycle of a series capacitor on a 24 hour basis is likely to be more favorable than that of a shunt capacitor even though an overload may exist for a short period of time.

"Another factor which has influenced series capacitor application is the cost of protection. The writer will take the optimistic viewpoint that as usage increases the cost of protection will go down.

"In the area pertaining to customer service, the record is not bad and is amenable to improvement by the use of circuit damping and positive protection.

"In an area which the writer considers of extreme importance namely, safety, the practice to date has a clean bill of health.

"After weighing all the pros and cons it is the writer's opinion that the use of series capacitors with distribution transformers will likely increase rather than diminish in the future."

Distribution design

Several papers were presented at the conference on some phase of distribution equipment design. One of these, by R. G. Yerk, chief engineer, of Hughes Brothers, Inc., Seward, Neb., dealt with the design of wooden distribution structures. This presentation took the form of numerous photo slides and drawings showing actual installations. Most of these incorporated wood cross arm braces into the design with a view of increasing strength, safety for the lineman, and higher impulse insulation. Included in the discussion were designs for a single-pole transmission lines designed to avoid overhang on private property, and several special structures for distribution in business district alleys.

Another topic covered in this general category related to underground service for residential areas. Presented by G. T. Hays, division head for underground lines, Dallas Power and Light Co., this discussion described several existing residential subdivisions served from an underground distribution system. Two of these involved residences having annual kwh usage of 50,000 to 65,000, and the cost of the underground system exclusive of transformers was $1,200 to $1,500 per lot although the cost of connecting one particular lot ran $3,200 without transformer.

One of these subdivisions was served from primary cable buried directly in the ground along easement in the rear of the lots. Two 15-kv single-conductor cables and a bare neutral was encased in a sand cushion with a two-inch slab over the sand. Transformer vaults were semi-buried and placed on lot lines so that two residences could be served from each vault. The customer extended his service directly into the secondary side of the vault.

In the case of another development, primary cables were buried under the street pavement. Transformer vaults were completely underground and customers extended their service cables into a vault or into a splicing box on a lot line.

Another paper in the design category was presented by two distribution engineers of the Westinghouse Electric Utility Engineering Dept., D. N. Reps and A. D. Patton. Entitled "Fundamentals of Primary and Secondary Circuit Design," this presentation discussed the method of determining the most economical distribution transformer and secondary circuit combination.

In their conclusions, the authors reported:

"Distribution system design for lowest over-all cost entails the simultaneous consideration of both primary and secondary voltage levels and the circuits and equipment associated with these integrated system components. Choice of the lowest cost combination of distribtuion transformers and secondaries is the first step in system design. Analysis shows that such designs covering a wide range of load densities and primary-feeder voltage classes give minimum cost when secondary voltage drop is increased as load density and primary-feeder voltage are increased.

"This design principle for distribution transformer - secondary combinations is fully compatible with primary-feeder design principles which show that if load density and primary-feeder voltage are allowed to increase, per cent voltage drop in the primary feeder must necessarily decrease.

"The over-all result of integrated primary and secondary design is to assure a lowest cost distribution system that is capable of serving any load pattern while accomplishing the desirable dual objective of keeping voltage spread within acceptable limits."

Power system capacitor seminar covers design, control, economics

◆ THE SANGAMO Electric Company's second annual workshop seminar, held in Greenville, S. C., recently, produced what is probably the most comprehensive treatment of capacitors on electric utility company systems ever conducted in the South. The subject of measurement and control with respect to capacitor applications received special emphasis. The speaker list included utility company engineers, educators, and Sangamo executives and engineers.

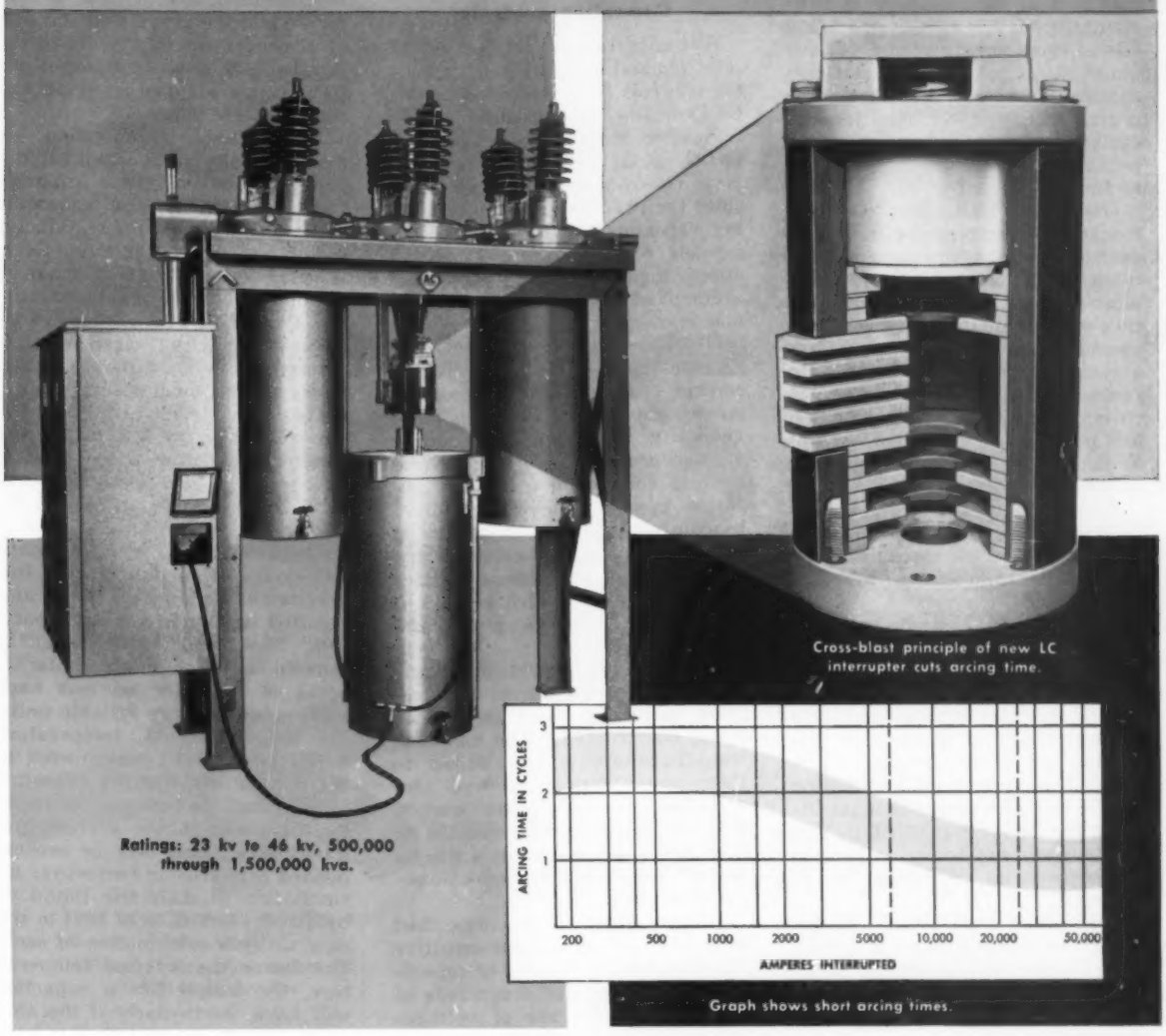
The first session of the workshop was opened with a general discussion of capacitor application presented by Prof. Norman F. Rode, of Texas A & M College.

"Power capacitors have become as necessary in the electrical systems as transformers," Prof. Rode said, "and no system planning of the future can be termed good without giving careful engineering consideration to how much capacitive kva should be added and where with each increase in load. Furthermore, regular and proper instrument checking of distribution systems will have to follow to make sure that the actual conditions resulting on the system are following the engineering planning."

"Reclaiming System Peaking Power" was the title of a presentation made by Robert R. Wylie, manager of marketing, and Irving H. Peak, both of Sangamo Electric Co. In this discussion, the development of a specific problem pointed up the fact that static capacitors offered the most economical answer to the peak load problem where system peaking capacity is entirely thermally limited.

In comparing static capacitors on primary distribution system as an alternate to the installation of peaking generation on the subtransmission system, the authors

ALLIS-CHALMERS... Pacing Power Progress



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Here's new high-speed interrupting efficiency for Allis-Chalmers frame-mounted circuit breakers. New LC interrupter cuts arcing time. There's greater system protection, less oil contamination. Dielectric strength is extended, maintenance lowered.

More A-C breaker bonus benefits! You get mechanically trip-free operation. Highly successful *Pneu-Draulic* operator provides fast operation — ends moisture, rust, freezing. Hydraulic power-operated tank lifter cuts raising and lowering time by 80%.

For all the facts on these frame-mounted breakers, call your nearby A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

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pointed out that capacitors offered these advantages: (1) additional fuel cost at steam plants is substantially lower than operating cost of small peaking units, (2) reduced losses in the subtransmission system and distribution transdormers, (3) lower maintenance costs, (4) simpler and more compact installations, and (5) no noise or fume problems.

Glenn M. DeKraker, assistant marketing manager for Sangamo, discussed the importance of recorded data as an aid to system planning. He weighed the pros and cons of portable instruments versus permanently installed instruments at selected metering points. He recommended the instrument accuracy justified by the application and pointed out the importance of a record storage and handling system.

These are some of the factors that should be given consideration in the selection of instruments for a particular application, Mr. DeKraker said:

(1) If the instruments are to be installed and removed frequently, a design should be selected that is so simple that a serviceman could install the instruments correctly without checking phasing or disturbing any relay circuits.

(2) The method of installation should be made safe so that the installation and removal of instruments would not accidentally open the secondaries of current transformers.

(3) The installation design should be flexible so as to permit easy change of instrument range as the circuit load increases or as current transformer ratios are changed.

(4) Installation design should present a neat, compact appearance. This makes the wiring job easier. If a standard design can be obtained, the greater part of the assembly can be done in the shop and then installed in the station.

The importance of system measurements were discussed also by P. C. O'Shee, of Alabama Power Co. He described an economical instrument which his company adopted for installation at distribution substations. This is an indicating instrument which will give the maximum and minimum lead and/or lag power factor for each month of the year. The instruments have been installed at 122 of the 575 substations operated by the company. Regular monthly readings of these meters has enabled the company to install capacitor banks where they will serve to best advantage.

Capacitor controls

A comprehensive discussion of selection and application of capacitor controls was presented by W. C. Downing, of Sangamo. After reviewing the application of time switch and thermostat controls, Mr. Downing emphasized that since the primary function of adding capacitors to a system is to provide reactive power, it would appear logical to employ the measurement of vars in the circuit as a means of control.

He said that the watt-sensitive Lincolntrol is occasionally used to control switching on the basis of power, but that the device is more generally used with the supply voltage cross-phased in order to provide control on a basis of reactive power. The var-sensitive Lincolntrol, he said, is similar in principle to the watt-sensitive instrument but includes a phase-shifting network which permits it to measure reactive power directly.

While the instruments are available in polyphase form, they are most generally used in single-phase construction. The var control, therefore, is best suited to three-phase four-wire wye circuits, whereas the watt control may be more readily adapted to give var measurement on a single-phase basis for a three-wire three-phase system.

Other possibilities described were the use of current-sensitive Lincolntrols for control of capacitors on the basis of magnitude of current, and the use of voltage-sensitive Lincolntrols for switching capacitors as a function of line voltage.

The first day's session of the workshop seminar was concluded with a discussion of group fusing of pole-type capacitor banks by William J. Thacker, of Sangamo. He reported that service records have proved the dependability of group fusing at a minimum of 165% line current, and that in general tank rupture has not been a problem under the more conservative limitation of bank kvar rating. But closer fusing practice used in some instances, he said, poses the real possibility of violent tank rupture. He recommended that the industry accumulate more actual service experience data with such group fusing.

"Advancements in power capacitor design" was the title of the first discussion presented at the second day's session of the workshop seminar. J. F. Kuzela, of Sangamo, told the group that the pace of advancement in the art of designing and producing power capacitors has stepped up rapidly in the past few years.

"The NEMA organization has been partially responsible for this progress," he said, "but improvements in materials and techniques are largely the cause for producing higher quality capacitors. Great strides forward have been made by the manufacturers of capacitor tissue. Papers are now produced with fewer conducting particles, increased dielectric strength, lower losses and flatter loss-temperature curves. With such higher quality material, it is possible to produce smaller and lighter power capacitors without exceeding temperature rise limits set up by the industry.

"Improvements in production techniques of vacuum drying impregnation and testing have also resulted in higher quality capacitors. New concepts in design to remove heat from critical internal areas of capacitor sections have made possible more reliable units. To keep internal temperature down, heat must be conducted to the outside walls of the capacitor case, so that the heat may be readily dissipated to the surrounding atmosphere. This may be accomplished primarily in two ways: by circulation of dielectric liquid or by direct conduction of heat to the case, or by a combination of each. The lower the internal temperature, the longer life a capacitor will have, particularly if the ambient is well ventilated.

"Undoubtedly, as time goes on, we expect that improved materials will become available, new techniques will be discovered and advancements in design developed, that will make possible higher and higher quality power capacitors, at lower cost per kvar rating."

Computer solutions

L. John Rankine, of International Business Machines Corp., described a novel approach to the problems involved in locating shunt capacitor banks on radial type distribution feeders. Using these techniques, he explained, it is possible to obviate tedious manual computations.

Utilizing simple source data, it is possible to arrive at the following decisions by digital computer solution: (1) The total amount of

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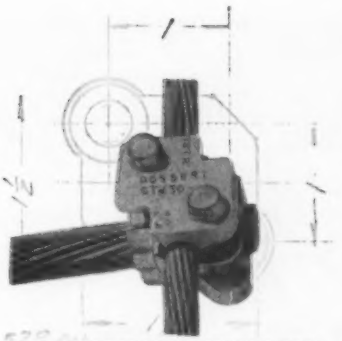

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(Type GTX)
For cross, parallel and tee tap connections.

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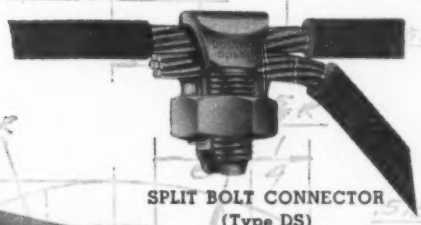
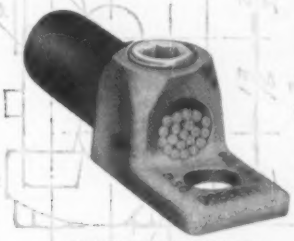
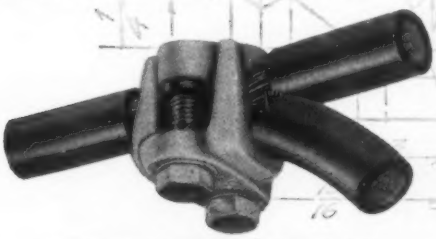
For economical, all-purpose cable connections.



SPLIT BOLT CONNECTOR
(Type DS)
For taps, dead-ends, entrances, motor leads, junction boxes, etc.



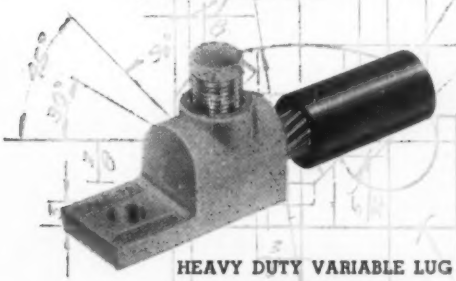
VARIABLE TERMINAL
(Type D)
Connects a wide range of copper conductors to flat bar.



TWO BOLT SERVICE CONNECTOR
(Type DSU)
For all service cable connections.
Best for larger sizes.

For YOU, the contractor...
For YOU, the wholesaler...

The products shown here are in constant demand by contractors and are fast moving stock items. All items accept a wide range of cables, thereby, minimizing the number of stock sizes. They are packaged in convenient quantities for ease of handling and are attractively labeled for quick identification.



HEAVY DUTY VARIABLE LUG
(Type HL)
Takes various conductor sizes.
Quickly installed.

Ask for pocket catalog, giving name of your distributor.

50 YEARS OF TECHNICAL KNOW-HOW

DOSSERT MFG. CORP.
249 Huron Street, Brooklyn, New York
Representatives in principal cities.

Distributed outside the U.S.A. and Canada by:
INTERNATIONAL GENERAL ELECTRIC COMPANY
Construction Materials and Lighting Sales
150 East 42nd Street
New York 17, N.Y. U.S.A.

ckvar to be applied to the feeder. (2 That portion of the ckvar which should be installed as fixed shunt capacity and that which should be switched. (3) The optimum sizes for both the switched and the unswitched capacitor banks. (4) The optimum locations for each bank so as to obtain a beneficial return in reduced system losses, improved feeder voltage, and released system capacity. (5) The estimated cost of the total shunt capacity to be installed on each feeder.

Although the technique used by Mr. Rankine in setting up the capacitor problem involves application of capacitors to reduce system power losses, their practical application indicates that they will yield desirable results from the viewpoints of released system capacity and improved voltage.

The concluding paper of the second day's conference was presented by Wendell C. Fowler, of Sangamo, who discussed voltage regulation with switched capacitors. Outlining a typical feeder problem, Mr. Fowler explained that many systems have followed the practice of locating rather large capacitors at points in the first part of the feeder. This method does not reduce the spread in voltages beyond the capacitor bank and does not reduce losses in the circuit beyond the capacitor location. He suggested that the capacitor bank might be located advantageously farther out on the feeder.

Discussing the use of multiple banks of capacitors on feeders, Mr. Fowler said that the capacitor bank might be divided into economically sized assemblies and distributed along the feeder, and its branches, for optimum combination benefits. For minimum losses, each capacitor bank should be located in the center of the segment of circuit to which it supplies reactive requirements. However, to achieve greater results in voltage regulation, its location may be moved farther out on the circuit to take advantage of the voltage rise it can produce. The geography of the circuit frequently controls what is possible. Satisfactory locations must avoid a conflict with other equipment needed on the poles and this often dictates actual location.

Design practices

Design practices in the application of primary capacitors was discussed by John R. Frey, Consumers Power Co., Jackson, Mich., on the last day of the seminar.

"In general terms," he said, "our design criteria is that capacitors should be installed as close as possible to the var load they are supplying. This statement is often misunderstood and interpreted to mean all capacitors should be installed on the distribution system near the customer. It must be recognized that vars are not only required by customers' equipment, but also by lines and equipment operated by the utility.

Voltage control

"In addition to supplying vars under normal operating conditions, Consumers Power installs capacitors to maintain voltage within 5% of normal under certain emergency conditions. These contingencies are loss of the two largest generators in an area or the loss of a generator and line, whichever is more critical.

"The quantity of capacitors to be installed is determined by supply area from load flow studies. These studies investigate normal and emergency conditions for both maximum and minimum load. The study results are the switched and unswitched capacitor requirements which now must be assigned to the transmission or distribution system and specifically located.

"Those capacitors required to compensate for the lagging power

Utility company engineers, Sangamo personnel, and others attending capacitor seminar in Greenville, S. C.

factor of the load are labeled 'daily use' capacitors, while those needed to maintain voltage under emergency conditions are called 'emergency' or 'stand-by' capacitors. The next step in planning is to determine how many of the emergency capacitors can be connected daily without exceeding the required voltage levels. Then, from the new grouping, all emergency capacitors are located in substations on the source side of the regulator and as many daily use capacitors as design limits will allow are installed on the distribution primary.

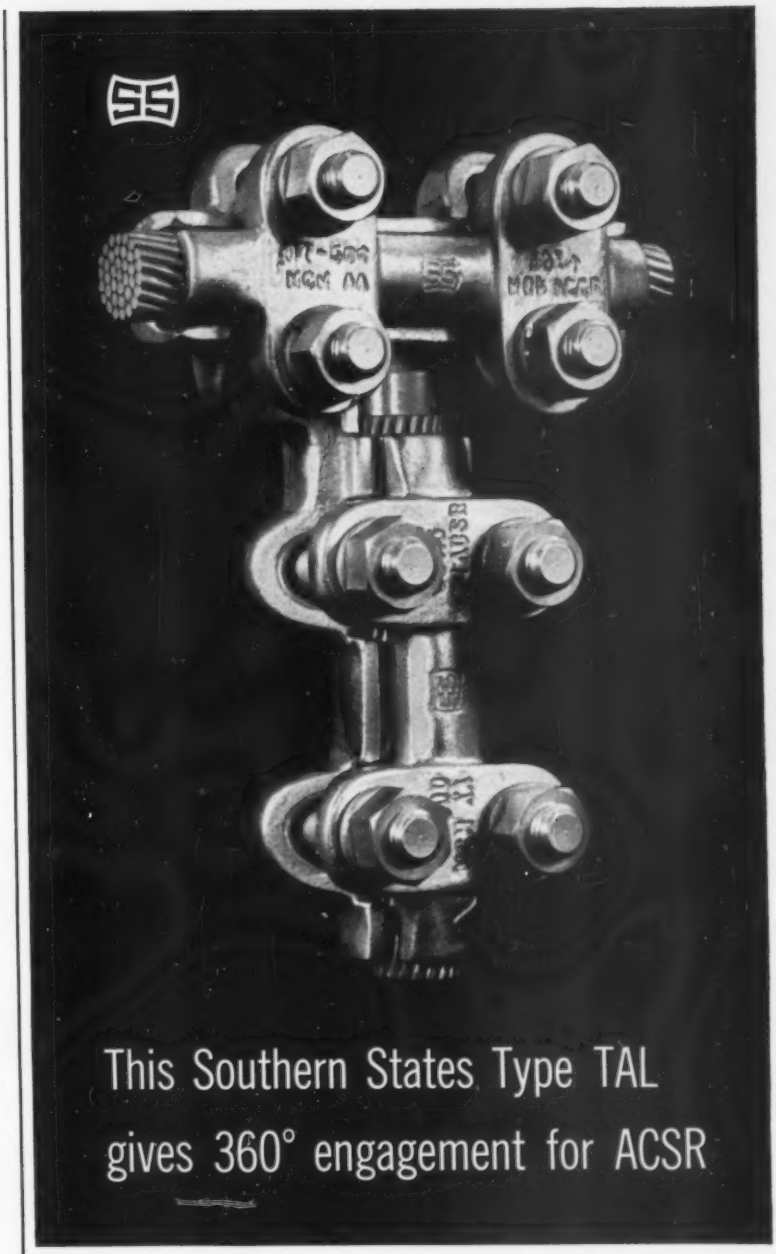
"The purpose of capacitors on the distribution system is to compensate the system at the substation bus for all reactive load and losses. In other words, capacitors are installed at either the bus or on the primary to give as close to unity power factor as practical under both maximum and minimum load conditions . . .

"One of the less glamorous tasks in capacitor application is maintaining records. Both transmission and distribution planning is dependent upon accurate and current information about location, size, and switching methods of existing capacitors. This data must be available for both capacitors on our own system and those capacitors installed on the premises of industrial customers. The problem of maintaining these records and analyzing them for specific projects becomes more acute with each additional capacitor installation. Our solution to this problem is a card file system which lends itself to automatic data processing. We hope to have such a system in operation within six months."

Some of the problems entering into design considerations of capacitor mounting equipment were discussed by Robert W. Tracey, of Sangamo. He presented detail information on the considerations entering into the selection of metal, method of fastening, and structural design. In conclusion, he summarized as follows:

"Power capacitor racks ranging from the smallest NEMA hangers to the largest elevating structure and stacking units are designed with the lightest and strongest and most economical aluminum shapes available. Aluminum assemblies are jig welded to insure positive alignment of mating parts. Corrosion factors are adequately compensated for not only in structural members but in the consideration

(Continued on page 100)



The unique design features of this connector reflect the engineering behind the entire Southern States line of fittings. For instance, to assure good electrical and mechanical characteristics, it provides independent clamping on run and tap conductors; its maximum contact engagement minimizes conductor clamping stresses; and conductor-fitting grooves limit cable distortion.

SOUTHERN STATES
EQUIPMENT CORP.
HAMPTON, GEORGIA

IN CANADA Dominion Cutout Co., Ltd., Toronto

F-P Sent to Washington ...Capital Gains

PEPCO REPORTS DEPENDABLE OPERATION WITH MERCURY VAPOR LAMPS, NO FALSE TURN-OFF FROM HIGH AMBIENT OR LIGHTNING

Potomac Electric Power Company now has in operation several thousand Fisher-Pierce Series 6600A controls, the majority on mercury vapor luminaires fed by underground 120-volt secondary lines. Despite the fact that Washington is an area of many thunderstorms, there have been no reported cases of turn-off by light from lightning flashes. The Fisher-Pierce controls have also proved particularly useful in areas with nearby bright lights, since the directional design of the control permits orientation away from electric signs and other sources of strong artificial light.

PEPCO first began using Fisher-Pierce controls in 1957, and the number has grown until now F-P Series 6600A's comprise approximately 45% of all the individual controls in PEPCO territory — the District of Columbia and nearby areas of Maryland and Virginia. As the photos indicate, the variety of locations necessitates installation flexibility as well as dependability in the photo-electric controls.

GRAY COLOR and compact design of the 6600A Series control matches the modern PEPCO streetlight poles. All downtown structures in Washington—including streetlighting equipment—must meet rigid appearance standards.

PROGRESS IN WASHINGTON

Incandescent series streetlights are being replaced by new mercury vapor types, individually controlled by Fisher-Pierce 6607A models. The short time delay permits fast checking of the control. Below, PEPCO Mechanic E. E. Mayfield explains control installation to Junior Mechanic C. F. Madigan.

For complete design information and specifications on Series 6600A controls, write The Fisher-Pierce Co., 59 Pearl Street, South Braintree 85, Massachusetts.

FP

FISHER PIERCE

PHOTOELECTRIC LIGHTING CONTROLS

AN AFFILIATE OF SIGMA INSTRUMENTS, INC.

Notes on new utility equipment

Tilting insulator switch features Amplitact contacts

SOUTHERN STATES Equipment Co., Hampton, Ga., recently announced a new shuntless tilting insulator switch, the Type TRS. It is available in voltage ratings of 7.5 kv - 23 kv and continuous current ratings of 400 and 600 amperes. Switches rated 400 amperes have a momentary rating of

20,000 amperes, while those rated 600 amperes have a momentary rating of 40,000 amperes.

For the first time in a tilting insulator switch, Southern States has incorporated Amplitact contacts. This reverse loop type of contact provides more than adequate capacity for handling the short circuit currents for which the switch is rated.

The TRS features an extra-large sleet hood which prevents ice collecting on the contact assembly.

The TRS is generally applied for line sectionalizing, station disconnecting, and line tap disconnecting. The TRS is usually pole top mounted.

Write U-101 on reply card, pg. 17

Contour-molded packaging unit safeguards polyphase meters

A NEW STANDARD packing box, designed to accommodate all sizes of S-type meters and protect calibration during shipment, is being used by General Electric's Meter Department, Somersworth, N. H., for shipping polyphase watthour meters.

A contour-molded kraft pulp unit pack, the new package is constructed of a stronger material than the previously used corrugated cardboard. The

use of only two sections, top and bottom, reduces by half the number of internal packing parts previously used.

Because of the added strength of the new package, meters are subjected to less impact in shipment. Results of drop tests at the Somersworth plant show that maximum anticipated initial impact on any one of the carton surfaces during shipment and handling is 80 G's in the new box. In the older style package, it was possible for meters to be subjected to as much as 100 to 125 G's. Engineers said the added strength is provided by the structural molding which gives consistent cushion values on all surfaces.

Since the new pack accommodates all sizes of S-type meters, both old and new, the need for meter superintendents to stock several different sizes of boxes is eliminated. The standard carton size also results in more efficient warehousing.

The package has an easy lift-out top and its increased strength allows the rest of the carton to be used for shop tray purposes.

Write U-102 on reply card, pg. 17

Transformer compartment units supply underground protection

AN ENTIRELY NEW IDEA in pad mounted transformer equipment is reflected by Moloney Electric Co., 5390 Bircher Blvd., St. Louis 2, Mo., in their recently developed "Unitran," which is designed specifically for use by utilities planning underground residential distribution systems.

The "Unitran" consists of a transformer, LV compartment and a HV compartment designed to couple with each other in a single compact unit.

The compartments are fabricated of heavy gauge sheet steel and have ample space for connections and entrance of cables. Full width, weatherproof, tamperproof doors are provided on both compartments.

The HV compartment has provisions for mounting lightning arresters and potheads. In addition, the HV compartment may contain a fused disconnect - sectionalizing switch for loop feeder service.

The switch can be operated under load without an external arc by using a commercially available load break tool. Thus, the switch provides a means for sectionalizing a portion of the loop feeder and the fuse provides for transformer protection and isolation.

The second development is a safe, attractive enclosure for those utilities desiring to use conventional pole type transformers for underground residential service. This enclosure is constructed of heavy gauge sheet steel and is equipped with doors on each

end for ease of maintenance and installation.

The "Unitran" is available in voltages 15 kv grounded Y and below; in conventional transformers 15 through 167 kva, or in CSP units 15 through 50 kva. The enclosure is suitable for use with comparable ratings of pole type units.

Write U-103 on reply card, pg. 17

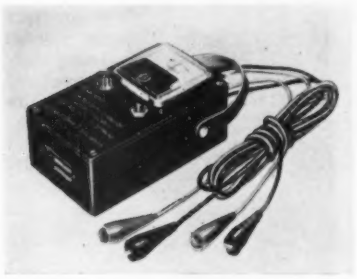
Transformer polarity checker indicates correct markings

EASTERN SPECIALTY Co., 3617 N. Eighth St., Philadelphia 40, Pa., announces production of a unique instrument, that is used to check the correctness of polarity markings on transformers, through a great range of sizes.

It operates equally well on small electronic and instrument transform-

ers, metering transformers, both potential and current, and large power transformers. A sensitivity control adjusts the current to suit the size of the transformer to be checked.

In operation, the transformer polarity checker's two leads carrying the test current are connected to one of the transformer windings. The other two leads from the indicating meter are connected to the other winding. When the push button is depressed, direct current from a small dry cell flows through the transformer winding. The momentary induced voltage in the other winding causes the center-zero milliammeter to deflect in one direction. When the push button is released, the reverse



induced voltage causes an opposite deflection.

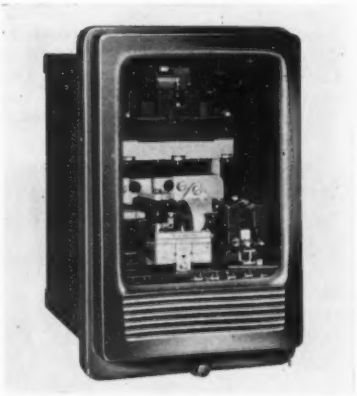
An additional feature is that this device can be used to check out the correctness of the wiring in a transformer rated meter installation.

The small portable meter requires no calibration, and the size D dry cell is easily and quickly replaced. Size 3¾" wide x 6½" long x 2⅝" high.

Write U-104 on reply card, pg. 17

Reverse-power relay available for use on three-phase system

A NEW directionally-controlled timing relay (type CRN-1) for reverse-power, three-phase applications is available from the Westinghouse Electric Corp., Box 2278, Pittsburgh, Pa.



The CRN-1 relay is rated 120 volts line-to-line, five amperes. The main contacts can close 30 amperes at 250 volts d-c and carry this current for sufficient time to trip a circuit breaker.

Some of the features of this new relay include high sensitivity of 0.02 amperes, 120 volts at maximum torque, adjustable timing range from 2.0 to 40 seconds, small-size Flexitest case, and low burden. The relay is completely self-contained.

Write U-105 on reply card, pg. 17

New device determines soil classifications

A NEW DEVICE for accurately determining soil conditions is now being marketed by the A. B. Chance Co., 210 N. Allen St., Centralia, Mo. The Earth Probe is used to find the correct classification of the soil before an anchor is installed.

The Probe is a five-foot rod with a screw-type head. (Extension rods come with the tool.) It is screwed into the ground to the depth the anchor will be installed with a special wrench equipped with a torque scale.

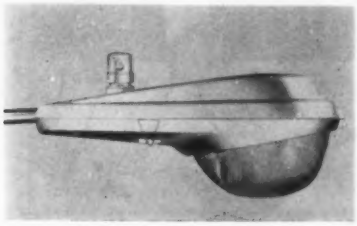
Torque readings are translated into soil classifications using a conversion table, fitted into the flap of the Probe's carrying bag.

Write U-106 on reply card, pg. 17

Integrally ballasted units for high-level lighting

INTEGRALLY BALLASTED mercury luminaires are now available from Line Material Industries, 700 W. Michigan, Milwaukee 1, Wis.

Designated Line 2A2, the new fixtures are designed for high level lighting of streets, highways, and parking areas. They are equipped with an adjustable mogul socket, a one-piece heat-resistant glass refractor, and a 120/240, 277, or 240/480-volt constant wattage or reactor ballast.



A series ballast is also available. The luminaires are furnished for use with or without a photoelectric control and accommodate clear or color-improved, mercury lamps rated through 400 watts. IES Types II, III, or IV are obtained by properly selecting the socket setting and the lamp.

A permanent mold cast aluminum housing rigidly supports other luminaire components. A spring-loaded reflector and a waterproof dacron felt gasket provide a weather-resistant seal between the refractor and reflector. The adjustable slip fitter compensates for pole rake and can be mounted on either 1¼-inch or 2-inch pipe.

Write U-107 on reply card, pg. 17

Oscillating derrick's vertical operation arc is 200 degrees

McCABE-POWERS Body Company, 5900 N. Broadway St., St. Louis 15, Mo., has announced the addition of an all-new oscillating hydraulic derrick to its line of "Pole-Master" fully-powered derricks.

The new unit, designated the Series PM-30 "Pole-Master," has a vertical operating arc of more than 200 degrees—extending from stowed position above the body to just above the

ground. Head sheave can be spotted at any point in this arc.

In addition to its vertical movement, the PM-30 "adds a new time-saving dimension to derrick operation." It can be moved horizontally, at any angle of elevation, to any point in a 180-degree arc which reaches from one side of the body to the other. The derrick's wide range of horizontal and vertical movement permits working in places where limited space would prevent the use of conventional single-arc derricks.

In congested areas, truck can be parked parallel to the curb, for handling the complete pole-setting job without blocking traffic.

The derrick cannot creep or kickback under load; cannot fall in event of damage to the hydraulic system. Controls, including those for winch, body jack, pole jack and engine speed, can be installed on rear body panel as shown or in location selected by user. All operation is hydraulically actuated, powered by a hydraulic pump driven by a power take-off installed on the truck transmission.

Write U-108 on reply card, pg. 17

Pad-mounted transformers supply residential service

A NEW LINE of single-phase pad-mounted distribution transformers with high- and low-voltage compartments at opposite ends of the unit has been announced by General Electric's Distribution Transformer Department, Schenectady 5, N. Y. The transformers, designed for residential underground systems, require no additional housings or fences.

Available in ratings of 25, 37 ½, 50, 75 and 100 kva, the new units are mounted entirely above the surface of a level concrete pad.

Separate, tamper-proof high- and low voltage compartments allow users to work in one compartment while the other remains closed and electrically isolated.

Both compartment doors are on stainless steel lift pin hinges for easy removal when inspection and servicing are necessary. The design is particularly adaptable to installations where space is restricted by fences or shrubbery.

Construction is particularly arranged to allow sliding the unit onto a mounting pad with cables in place, thus eliminating the necessity of lifting the transformer over the entrance cables.

The new design makes possible installation of any rating on a given pad, or the changing of any kva rating for any other size. Pad anchoring and cabling dimensions are standardized for all ratings. Secondary busses are identical so that individual customer service connections need not be disturbed during change-out to a larger kva transformer.

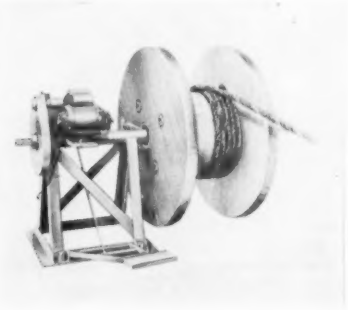
Write U-109 on reply card, pg. 17

Wire rope reeler and coiler is economical and powerful

SHERMAN AND REILLY, Inc., First and Broad Streets, Chattanooga 2, Tenn., introduces their new heavy duty reeler and coiler, electrically driven with completely enclosed, oil immersed gear reducer.

It is economically built without sacrificing any of the convenience features of the most expensive machines, and has tremendous pulling power for reeling and coiling from the largest standard master storage reels. The electric motor is heavy duty capacitor type with 400% overload rating, 110/220 volt, 60-cycle, single-phase.

Equipped with 20-inch diameter coiling head, the reeler and coiler



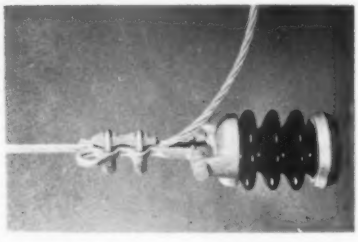
gives rope speed of 89 feet per minute allowing safe operation by any inexperienced person. The shaft is 2-inch diameter for small reels, and two reel bushings are furnished for 5-inch arbor holes for all reels up to 38 inches in diameter, or 2,500 pounds.

Write U-110 on reply card, pg. 17

Slack-span strain clamps provide better dead-ending

A NEW SERIES of strain clamps that provide an entirely new approach to slack-span dead end construction is announced by Lapp Insulator Co., Inc., Le Roy, N. Y.

Clamps are a straight line design



Join the march to the finest in die casting
ECONOLINE
DEPENDABLE CONDUIT FITTINGS
Your Best Connection for Quality Fittings
DURO SALES COMPANY
2210 So. Davie Avenue • Los Angeles 22, Calif.

the KUHLMAN 60

INTRODUCING THE

ALL NEW QUICK GRIP

The transformer bushing that reduces radio noise without oil

The new Kuhlman "Quick Grip" H. V. bushing offers revolutionary, positive reduction of radio interference. No oil is needed even at higher voltages. The bushing shank fits into a stress relieving ground sleeve normally used only with power transformer bushings. The sleeve's surface prevents any concentration of stresses that could cause radio noise.

Get complete facts about ALL NEW revolutionary "Quick-Grip" from your local Kuhlman representative.

AND HERE ARE MORE OUTSTANDING FEATURES:

1. **A new protective hand grip**—permits line connections without use of tools . . . gives full protection against service interruptions caused by birds and animals coming in contact with live parts.

2. **New conductor capacity**—with spring loaded terminal, accommodates a wider range of aluminum conductors as well as copper.

3. **New porcelain construction**—with heavier, sturdier skirts, provides ample creepage with less chance of breakage.

4. **New internal clamping**—eliminates all external hardware. The same stress relieving ground sleeve does the clamping. Its simple one-piece construction evenly distributes mechanical stress along the bushing shank and threads into the transformer cover, not the bushing.

5. **New Quick Disconnect**—disconnects the bushing without the use of tools. A simple quarter turn of the disconnect at the base of the bushing disengages the bushing lead, leaving the cover or bushing free for removal.

KUHLMAN TRANSFORMERS

KUHLMAN ELECTRIC COMPANY, Birmingham, Mich.

Manufacturers of transformers since 1894

Southern Division: CRYSTAL SPRINGS, MISSISSIPPI

THE ONLY RECEPTACLE THAT PROTECTS 2 WAYS

1. Shunts current harmlessly away from objects inserted in slots by children.

2. Provides grounding protection for users of power tools and equipment.

NEW HUBBELL
SG-62 SAFETY GROUNDING RECEPTACLE
15 AMPERES, 125 VOLTS

TWINSAFE

No other receptacle combines these two protective features. Each unit of the "Twinsafe" duplex accepts all U-shaped or round-pin standard grounding caps, and each is designed so that current flows to the paired slots only when the cap is firmly seated. When the cap is removed, no object inserted in the slots can touch any electrified part.

The SG-62 "Twinsafe" will be welcomed wherever young children play near convenience outlets in homes, schools and nurseries. In addition, it fills a real need in hospitals, mental institutions and prisons where grounded receptacles for power equipment should be as tamper-proof as possible.

Remember, this is the only device on the market which combines grounding with the shunting action that Hubbell introduced in the famous SP-49 Safety Plus receptacle many years ago.

The SG-62 "Twinsafe" fits standard boxes and is available for 15 ampere, 125 volt circuits. It is now in stock at your electrical wholesaler's.

IT PAYS TO HAVE HUBBELL GOOD CONNECTIONS

Listed by Underwriters' Laboratories, Incorporated

HARVEY HUBBELL, INCORPORATED

BRIDGEPORT 2, CONNECTICUT • IN CANADA SCARBOROUGH, ONTARIO

available in aluminum or galvanized, malleable iron, in five sizes for conductors ranging from .16-inch to 1.56-inches. Used with standard Lapp clamp top line posts, the new clamps provide a taut, neat appearing assembly, completely free from radio and television interference.

Mechanically, the clamp and insulator assembly has a 5000 lb. tension rating. The clamps have good holding power without damaging conductor. They attach to the clamp-top cap on the insulator with a single capscrew. Insulator is installed with a single mounting bolt and the complete assembly can be rotated during installation, controlling the position of the clamp so that the jumper can be trained away in any position desired.

Used with these new clamps, the clamp top post is ideal for slack-span applications. The wet flashover of the post, mounted horizontally, is practically as high as the dry flashover value, and resistance to contamination is at a maximum because each petticoat drains free and clear of all the others under light rain or fog conditions.

Write U-111 on reply card, pg. 17

Relay tester is equipped for distance, multi-uses

A HIGH-CURRENT relay test set with built-in instrumentation for testing and calibrating distance relays is obtainable from Multi-Amp Division, Multi-Amp Electronic Corp., Union, N. J.

Although developed originally for servicing distance relays, the set is suitable for testing differential, directional and other types of protective relays.

This Multi-Amp unit is rated 0.4 kva and is designed for 120 volt, 3-phase, 60-cycle operation. It has current output, voltage output, potential supply for three-phase testing. The relays can be tested single phase one phase at a time. Instrumentation includes a multi-range ammeter, a multi-range voltmeter, a timer, and a phase-angle meter which has a circular scale for 0-360 electrical degrees.

A continuously adjustable transformer affords many combinations of output currents from 12.5 amperes at 32 volts and up to 100 amperes at 4 volts. Voltage output is obtained by the transformer tertiary winding with a capacity of one ampere at 150 volts. Potential supply is zero to 120 volts and zero to 10 volts, 60 cycles a-c, continuously adjustable in magnitude, as well as phase angle (by means of an external phase shifter).

Directional relays may be tested by the unit when a throwover switch is in position for proper connections to the variable autotransformer.

Write U-112 on reply card, pg. 17

Understanding the Code

By Walter R. Stone

This article should be especially helpful to the following readers:

Electrical Contractors ✔
Electric Utilities ✔
Electrical Wholesalers ✔
Electrical Inspectors ✔
Industrial Engineers ✔
Consulting Engineers ✔

◆ WE CONTINUE in this issue with our analysis of the changes in the new Code. Frequently, fine print notes which appear appended to various sections of the Code for a time are later changed to regular Code sections or sub-sections. One such fine print note which formerly appeared following the title of Article 300, and another which followed Section 3001 in the old Code now appear as Paragraph (c) and (d) respectively in the new Section 300-1.

Since the contents and wording of both remain unchanged and since both were thoroughly discussed in the April, 1959, issue of ELECTRICAL SOUTH in this department—Understanding The Code—we will quote them here without further comment except to point out that such a change from a fine print note to a formal Code section usually indicates agreement among the majority of Code authorities that the subject covered merits greater status or emphasis as a result of changing conditions or as a result of additional accumulated proof. Since Paragraph (a) of this section is new and Paragraph (b) has a slight change, we will quote the entire section, remembering that Paragraphs (c) and (d) cover the material previously appearing as fine print notes:

"300-1. Scope:

"(a) The provisions of Chapter 3 apply to the electrical and mechanical requirements for the various methods of installing fixed electrical conductors for electric light, heat and power and certain signal systems.

"(b) The provisions of this Article shall apply to all wiring installations, except for remote-control, including low voltage relay switching, low-energy power and signal systems as provided in Article 725, and communication systems as provided in Article 800.

"(c) On premises where a continuous underground metallic waterpiping network system is not available as a grounding electrode,

---

Code test questions

1. 750 MCM cables which are installed in a vertical raceway and which normally would require supporting at intervals not greater than 40 feet where approved insulated wedge type supports are used would have to be supported at intervals not exceeding 8 feet if the means of support consisted of deflecting the cables 90 degrees in junction boxes and securing them to insulating supports by means of tie wires. True or false?

2. A No. 1 Type TW conductor rated to carry 110 amperes would be permitted to carry only 55 amperes if it were enclosed within the same raceway as 54 other current-carrying conductors. True or false?

3. Open wiring on insulators may be used for both concealed and exposed work. True or false?

4. In dry locations where supports for knob-and-tube wiring are impracticable to install and the conductors have to be fished, they may be separately enclosed in flexible metallic tubing. True or false?

5. All types of armored cable except Types ACL and ACV, in all sizes, shall have an internal bonding strip of either copper or aluminum in intimate contact with the armor for its entire length. True or false?

6. Where non-metallic sheathed cable passes through a floor, it shall be protected from physical injury by means of:

(a) any mechanical protection, such as guard strips up to a point at least 8 inches above the floor.

(b) rigid metal conduit up to a point at least 8 inches above the floor.

(c) rigid metal conduit or metal pipe extending at least 6 inches above the floor.

Which is correct? a? b? or c?

7. The uninsulated conductor of service-entrance cable:

(a) may be used as the equipment grounding conductor on any 220-volt appliance.

(b) shall not be used as the equipment grounding conductor on any appliance other than hot water heaters.

(c) shall not be used as the neutral conductor when such cable serves as a feeder from a service cabinet to supply another building.

Which is correct? a? b? or c?

8. Liquid-tight flexible metal conduit:

(a) may be used in any location and for any purpose approved for flexible metal conduit.

(b) shall not be used except for the connection of motors or portable equipment where flexibility of connection is required.

(c) has been deleted as a wiring method from the Code.

Which is correct? a? b? or c?

9. The number of conductors in a surface metal raceway shall not exceed:

(a) ten.

(b) thirty.

(c) the number of conductors for which the raceway is designed.

Which is correct? a? b? or c?

10. Fixture wires shall be not smaller than:

(a) No. 14.

(b) No. 16.

(c) No. 18.

Which is correct? a? b? or c?

Correct answers will be found at end of article on page 98.

and where it is not practicable otherwise to secure a ground of permanently low resistance, the use of a wiring method which does not employ metal enclosures for the wires is recommended, unless the character of occupancy of the building is such as to require the use of a metal-enclosed wiring system.

"(d) The provisions of this Article are not intended to apply to the conductors which form an integral part of equipment such as motors, motor controllers and the like."

There has been a change in wording in Section 300-10 which may cause some confusion if not explained. This section includes requirements which formerly appeared in Section 3004 and 3016. Previously, reference was made to *interior* metal raceways, etc. The word *interior* has been deleted and the section now reads as follows:

"300-10. Electrical Continuity of Metal Raceways and Enclosures. Metal raceways, cable, armor, and other metal enclosures for conductors, shall be metallically joined together into a continuous electrical conductor, and shall be so connected to all boxes, fittings and cabinets as to provide effective electrical continuity. Raceways and cable assemblies shall be mechanically secured to boxes, fittings, cabinets, and other enclosures, except as provided for nonmetallic boxes in Section 370-7."

The word *interior* was properly deleted because such equipment used outdoors merits at least as much attention to grounding continuity as that installed indoors. But the question may arise as to whether this change was intended to banish the practice of using direct-burial wire or overhead spans with metal raceways used only at each end where mechanical protection is needed. No such change as this was intended. Grounding continuity by means of bonding is required where needed in such cases, but raceways are not required to be run along the entire length of such installations.

Conductor supports

Section 300-19 (old Section 3014) has been changed by the addition of a new sentence to Paragraph (b) (3) adding another restriction to the use of 90-degree conductor offsets on insulators in junction boxes for conductor supports in vertical raceways. This new sentence states, "When this method is used cables shall be supported at intervals not greater than 20 per cent of those mentioned in the preceding tabulation." [Refers to table in 300-19 (a)]

As we mentioned in this department of the January, 1959, issue of ELECTRICAL SOUTH, such archaic methods of supporting conductors in vertical raceways is seldom resorted to anyway by reputable contractors in this day and age when easy-to-use and practical devices factory-designed for the purpose are so readily available.

Now, by the provisions of the new Code, five times as many supports are required when the out-of-date improvised method of offsetting and tie-wire securing on insulators is used as are required for the same installation when approved and UL listed vertical raceway supports are used.

As an example, a vertical run of 500 MCM wire extending upward a distance of 50 feet would require only one approved support. The same installation would require five junction boxes with insulators for the offset type supports.

Article 310—Conductors — has been revised to include several new types of wire and insulation in the several tables and sections. Type WP wire has been deleted from the list because it is not and never has been intended for interior use or for general wiring since it has a covering only and no insulation. It still may be used, however, as in the past, out of doors in free air or where required clearances are maintained by the use of insulators.

A new fine print note has been added to Table 310-2 (a) stating, as was always intended, that conductors which have been approved for fixture wiring only is not approved for branch circuit wiring or for connections to portable or stationary appliances. The new Article 402 has a new section covering this which will be discussed later in this article.

Insulation details

Two new fine print notes have been added to Table 310-2(h-1). One states that insulations of rubber for potentials exceeding 2,000 volts shall be of ozone-resistant types. The other note, together with a separation in the table listing itself, indicates that conductor sizes No. 14 and No. 12 are approved for potentials not exceeding 2,000 volts; size No. 10 is approved for potentials not exceeding 4,000 volts; and size No. 8 is approved for potentials not exceeding 5,000 volts.

Section 310-3 consists of two paragraphs which formerly appeared as two fine print notes. It states:

"(a) The rubber insulations include those made from natural and synthetic rubber, neoprene and other vulcanizable materials.

"(b) Thermoplastic insulation may stiffen at temperatures below minus 10°C (14°F) and care should be used in its installation at such temperatures. It may be deformed when subject to pressure; care should be taken in its installation, as for example, at bushings, or points of support. See Section 373-6(b)."

The section referred to requires insulated bushings, or equal protection, where conductor sizes No. 4 or larger enter raceways.

The several notes which precede Tables 310-12 through 310-15 are the notes which previously followed Tables 1, 1-a, 2, and 2-a in the old Code. Note 8 (old note 4) now recognizes the unlimited number of conductors in a raceway, as already discussed in this department, and specifies a graduated derating scale for any given number of current-carrying conductors exceeding three in a raceway.

Open wiring on insulators has been re-defined in Article 320 as being suitable for exposed wiring only. It formerly was treated as either an exposed or a concealed type wiring with the further provision that if concealed it must comply with the requirements for knob-and-tube wiring. Since it *is* knob-and-tube wiring when concealed and therefore no longer open wiring on insulators, this change is a realistic and long overdue revision.

New bonding requirement

Section 334-2(a) is new and requires the already familiar bonding strip on armored cable. It states, "All types of armored cables except Types ACL and ACV, in all sizes, shall have an internal bonding strip of either copper or aluminum in intimate contact with the armor for its entire length."

This bond is required to insure against a total ohmic resistance in the armor beyond a safe limit when the armor acts as the equipment grounding conductor. The Underwriters' Laboratories have had this requirement for some time with a total specified maximum ohmic resistance for each 100 feet in length in the various sizes.

Article 338 — Service-Entrance Cable—has been clarified considerably. It has also been extended to permit the use of service-entrance cable with uninsulated neutrals for branch circuit wiring to wall-mounted ovens and counter-mounted cooking units as well as to ranges and clothes dryers.

Service-entrance cable rules

The previous puzzling and contradictory statement about water heaters has been deleted. In its stead, the following explanatory fine print note has been added which applies not only to water heaters but to any other appliance: "The above provisions do not intend to deny the use of service-entrance cable for interior use when the fully insulated conductors are used for circuit wiring and the uninsulated conductor is used for equipment grounding purposes."

In other words, the uninsulated conductor may be used for equipment grounding without the restrictions which prohibit its use for a neutral conductor. As a neutral, the uninsulated conductor may be used only for ranges, range tops, ovens, clothes dryers, feeders to other buildings, and for service entrances.

Section 338-3(c) is also new. It states, "Service-entrance cable used to supply appliances shall not be subject to conductor temperatures in excess of the temperatures specified for the type of insulation involved."

Section 338-5 states, "Cable with the neutral conductor smaller than the ungrounded conductors shall be so marked." Previously, this requirement appeared only as a fine print note following Section 2121-c. The same fine print note still appears following Section 210-19(c) in the new Code as well as in the section quoted above.

Old Article 340 — Non-Metallic Waterproof Wiring—has been deleted from the Code. This now-deleted wiring method consisted basically of heavy duty cords, such as Type S, with connectors similar to those used on shipboard for marine cables, and supported by appropiate insulating devices. It was never used extensively, the necessary materials were never manufactured for general distribution, and no materials were ever listed by the UL as safe for such use. In the one or two instances where this wiring method was used, the installation was made to satisfy a condition peculiar to breweries and was approved locally. Apparently, it was suitable for its restricted purpose but not for general use. Hence, it was removed from the list of Code-recognized wiring methods.

Section 348-11 is new. It states, "**Reaming.** All cut ends of electrical metallic tubing shall be reamed to remove rough edges." The requirement for reaming rigid conduit appears in Section 346-7 but is not new in Article 346 as it is in Article 348 for EMT. This, of course, is standard practice for all raceways, and the requirement had been previously omitted for EMT merely by oversight.

Underfloor wiring

In the old Code, Section 3542 specifically prohibited the use of underfloor raceways in commercial garages. Section 354-2 of the new Code no longer mentions this prohibition. However, it still states that this type of raceway shall not be used "in any hazardous location." Since a commercial garage is a hazardous location up to a level 18 inches above the garage floor and since underfloor raceway is used only when embedded in a floor, the restriction remains, and no real change has been made. A redundant statement has merely been deleted.

Sections 356-2 and 358-2 for cellular metal floor raceways and cellular concrete floor raceways respectively, without change in the new Code, treat this subject in a slightly different manner by stating that these raceways are not permitted "in commercial garages, except for supplying ceiling outlets or extensions to the area below but not above." In other words, the cells may be tapped for inserts extending *down* below the floor in which the raceways are embedded in order to provide outlets for the ceiling underneath. This practice is seldom resorted to, however.

All three of these sections for all of these three types of raceways (underfloor raceways, cellular metal floor raceways, and cellular concrete floor raceways) as well as Section 362-2 for wireways have deleted the former restriction to use in storage battery rooms. However, Section 480-7(c) governing wiring methods in storage battery rooms has not been changed to recognize these raceways or wireways in battery rooms. This section still states:

> "(c) **Wiring Method.** In storage battery rooms, bare conductors, open wiring, Type MI cable or conductors in rigid conduit or electrical metallic tubing shall be used as the wiring method. Rigid metal conduit or electrical metallic tubing, where used, shall be of corrosion-resistant material or shall be suitably protected from corrosion."

Until and unless this Section 480-7(c) is changed to include them, then, underfloor raceways, cellular metal floor raceways, cellular concrete floor raceways, and wireways cannot be used as the wiring method in storage-battery rooms. However, by the new provisions of, or rather by the new deletions from, Sections 354-2, 356-2, 358-2, and 362-2 all of these may now be run *through* storage-battery rooms to other areas just so long as none are used for wiring *in* any battery rooms. All of these are still prohibited for use in areas "where subject to corrosive vapor."

Wireways, then, which are not embedded in flooring as the underfloor raceways are, and which are not otherwise protected from corrosion, would not be permitted to be run through battery rooms which were not sufficiently ventilated to prevent an accumulation of corrosive vapors.

New wireway application

Another change in the rules governing wireways and also auxiliary gutters is the new recognition for their use out of doors provided that such wireways and auxiliary gutters "intended for outdoor use shall be of approved raintight construction." (Sections 362-2 and 374-9-f).

Section 370-15(a) has been changed so that non-metallic covers are no longer required with non-metallic boxes as formerly required by old Section 3711-a. When metal covers are used as now permitted, however, "they are subject to the grounding requirements of Section 250-42" which governs the grounding requirements for fixed equipment.

Table 373-6(a) which governs the width of gutters in cabinets and cutout boxes has been increased from six to nine minimum-size graduations for various size conductors. This provides additional steps to coincide with standard cabinet ratings when supplied with either aluminum or copper conductors.

Section 380-14(c) recognizes the relatively new a-c general-use snap switch for controlling inductive lighting loads up to the full

rated capacity of the switch by the addition of this sentence: "On alternating current circuits, general use alternating - current snap switches may be used to control inductive loads other than motors not exceeding the ampere rating of the switch." (The relative uses and merits of the various types of snap switches were discussed in this department in the October, 1959, issue of ELECTRICAL SOUTH.

A much-needed provision

Article 384—Switchboards and Panelboards—has one very important addition which appears as Paragraph (b) of Section 384-3. It states, "The arrangement of busbars and conductors shall be such as to avoid overheating due to inductive effects."

This new provision will prevent practices of poor design and improper installation methods which have been allowed to exist far too long. Now that connected loads are growing larger each year, this greatly needed Code provision will be welcomed by inspectors everywhere. Whereas they formerly had to ask for changes based on principle alone, they now have a definite and specific Code rule governing this condition. Suppliers and contractors will welcome this new rule, also, for it serves as a standard by which they can be guided, preventing costly and unexpected rejects by inspection authorities after sales and installations have been completed.

In plain language, this new provision prevents switchboard and panelboard installations which have steel barriers or other ferrous metal partitions or partial partitions of any kind between the neutral and the phase conductors, whether these conductors are factory-installed bus bars or contractor-installed wires or busses.

Previously—not in all cases, by any means, but in some cases—the supply conductors would enter one end, say the top, of a switchboard, go through the switch and overcurrent devices, and terminate in busses running along the bottom. The neutral bus, however, would be run across the top of the enclosure with some of the steel structure interposed between the phase busses at the bottom and the neutral bus at the top.

In such cases where the neutral currents were obviously great enough to cause heating and excessive voltage drop, the inspector frequently insisted upon costly re-arrangements. Where he did not ask for such changes, the contractor sometimes was called upon by the dissatisfied owner to "do something" about the generally unsatisfactory installation.

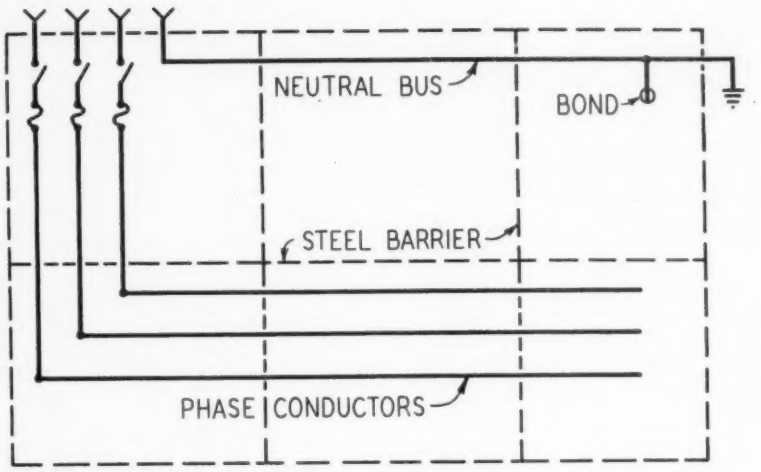


Fig. 1—Section 384-3 (b) prohibits the interposing of ferrous metal between conductors in such a manner as to cause inductive heating. This rule prevents the use of switchboard and panelboard installations which have steel barriers or partitions between the neutral and the phase conductors whether these conductors are factory installed or contractor installed wires or busses.

Section 384-3(b) should set everyone straight and prevent any further trouble in this respect. (See Figure 1).

Section 384-8 prohibits the space behind switchboards to be used as passageways. This is a new provision which was added to the requirement already in this section that this space not be used for storage.

Section 384-9 includes additional types of conductor insulations in the exemplary list provided for use in selecting conductors for wiring the back of switchboards.

The new Article 402, which actually only incorporates into a single article various rules on fixture wires which appeared formerly in a number of other articles, has in Section 402-1 a provision which is entirely new which we mentioned above in connection with a fine print note to Table 310-2(a). The new section states, "Fixture wires are designed for installation in lighting fixtures and in similar equipment where enclosed or protected and not subject to bending or twisting in use. Also, they are used for connecting lighting fixtures to the conductors of the circuit that supplies the fixtures."

This is followed by two fine print notes which state:

"For application in lighting fixtures, see Article 410.

"Fixture wires are not intended for installation as branch circuit conductors or for the connection of portable or stationary appliances."

This as well as the note to Table 310-2(a) clearly prohibits using fixture wire for branch circuit wiring and also helps to clear up the meaning of Section 410-65(b) (1) which states, "Branch circuit conductors having an insulation suitable for the temperature encountered may be run directly to the fixture." Although this provision clearly states branch circuit conductors with suitable insulation, there have been cases where electricians attempted to run fixture wire from the fixture back to a wall switch.

There can be no misunderstand-

(Continued on page 98)

Questions on the Code

(Readers are invited to send in questions which they would like to see discussed in this department.)

Calculating circuits and feeders for spot welders

QUESTION: Section 630-31 is so complicated that I am not sure what it means. I have to install ten resistance type spot welders operating on 60 cycle current. Each welder makes 600 welds an hour. Each weld lasts 15 cycles. The total listed primary current is 50 amperes on each machine, or a total of 500 amperes. What size wire

should be used to each machine and what size feeders to the entire group?

ANSWER: In answering a question such as this, the wire sizes given are not to be considered as either a recommendation or as a specification. They are, however, the minimum sizes permitted by the Code for the conditions stated.

There are 216,000 cycles an hour in 60-cycle current (60 x 60 x 60). At 600 15-cycle welds an hour, each machine is "in service" 9,000 cycles each hour, or just over 4 per cent of the time (600 x 15 x 100 divided by 216,000).

By the provisions of Section 630-31(a) (2) the primary rated current to each welder operating on 5 per cent or less duty cycle may be multiplied by a factor of 22 per cent. The rated primary current of 50 amperes times .22 equals 11 amperes. This would require a minimum of No. 14 wire for each machine.

By the provisions of Section 630-31(b), to the current thus obtained above for the largest welder, 60 per cent of the current (obtained in the same manner) of all remaining machines must be added for a total feeder capacity. The nine remaining machines at 11 amperes each equals 99 amperes. 60 per cent of 99 amperes equals 59.4 amperes. This 59.4 amperes for these nine machines plus the 11 amperes for the first machine equals 70.4 amperes. This would require a minimum of No. 4 wire (preferably No. 2) for the feeder to the group. If the length of the run is excessive, if the temperature encountered is excessive, or if the number of conductors in a raceway exceeds three, the conductor sizes listed would have to be increased.

This seems to be a remarkable reduction from the connected load of 500 amperes, but no machine is on more than 4 per cent of the time, and not more than 60 per cent (6 machines) are likely to be on at any one time; if they are, this should not occur more than 60 per cent of the time. If all machines are set to operate simultaneously (an unusual condition) the inspector could require wire size large enough to carry 11 amperes for each machine, or 110 amperes. This would require a minimum of No. 1 wire for the feeder. (Type TW).

No rule changes on fixture raceways

QUESTION: Please explain Section 410-26. I thought I understood this as it was written in the old Code in Section 4150. But from the way the new exceptions are worded, I am not sure whether there has been a change in meaning or not.

ANSWER: The wording in this section has been changed very slightly, but the meaning and intent remain unchanged. The manner in which the "exceptions" now follow up an "except" does tend to make the section more confusing, in my opinion, than the older arrangement. This is unfortunate, because the new arrangement in other sections of the Code has aided clarity.

Section 410-26 states, "Fixture Raceways. Fixtures shall not be used as a raceway for circuit conductors unless the fixtures meet the requirements for approved raceways, except that the conductors of the single branch circuit supplying the fixtures may be carried through as follows:

"Exception No. 1. An installation of fixtures approved for end to end assembly to form a continuous raceway, or

"Exception No. 2. Fixtures which are connected together by approved wiring methods."

This means that fixtures cannot be used as raceways unless approved for this purpose other than for the circuit conductors of a single 2-wire or multi-wire circuit which are supplying a number of fixtures connected together end-to-end or by other approved means. Conductors of another circuit cannot be run through these fixtures. But *one* conductor from *each separate phase* plus a *common neutral*, which together form a multi-wire circuit, may be run through, connecting first one phase and then another as needed and the neutral to the various fixtures. When this circuit is completely loaded, a second circuit must be carried directly to any additional fixtures and not run through the first group of fixtures.

This section might be made a little clearer if it were worded as follows:

Fixtures shall not be used as raceways for circuit conductors unless the fixtures meet the requirements for approved raceways.

Exception. Where fixtures approved for the purpose are connected end-to-end in a continuous row or by other approved wiring methods, conductors of the single branch circuit, including a multi-wire circuit, supplying such fixtures may be carried through the fixtures which are connected to this circuit. (See Figure 2).

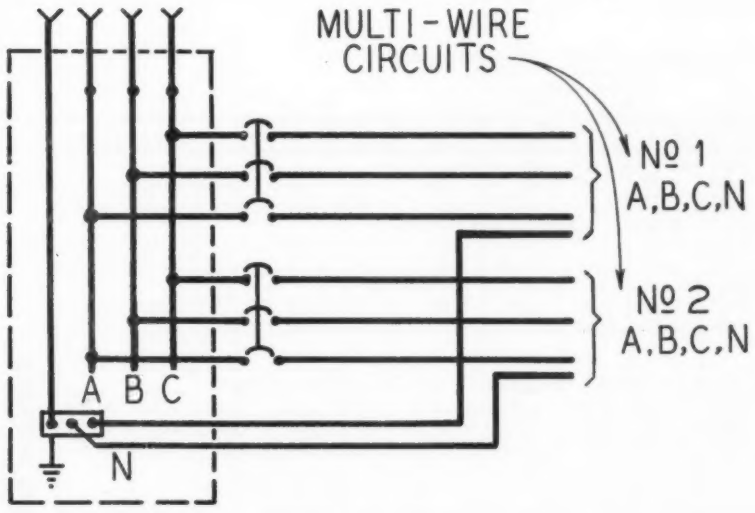


Fig. 2—Fixtures unless approved for the purpose cannot be used as raceways except to enclose the one circuit (which may be a multi-wire circuit) supplying the fixtures. For example, a group of fixtures not approved as a raceway, mounted end to end or connected by any approved method, may be served by circuit No. 1 or 2 shown above and all four wires may be carried through the fixtures which this circuit serves, but the second circuit must be carried directly to any additional fixtures and not be run through the first group using them simply as a raceway.

New series of tables extended to include larger hourly rates

A NEW SERIES of estimating tables, completely revised in the light of more recent jobs and experience, are presented in this issue and will appear from month to month in forthcoming issues. These electrical estimating data sheets cover labor only and are arranged alphabetically with the basic material headings as a title for each tabulation.

Labor units given in these tabulations are based on a minimum of interference during work progress. The averages listed do not provide for abnormal job conditions, and any such abnormal conditions will require adjustments by the user, based on his experience.

The work units covered by each table are composed of one or more separate but closely related operations necessary for the complete installation of a particular basic item of electrical equipment. These operations associated with the basic material are described at the bottom of each table.

Most of the electrical estimating tabulations follow the same form. Column 1 at the left shows the size of the material to be installed. The second column from the left gives the time required to install the material, and it should be noted especially that this "productivity" column may be based on individual units or in the case of cable or conduit on units of 100 feet or 1,000 feet. The abbreviations "Ea." for each, "C" for hundreds, and "M" for thousands in Column 2 indicate the basis of the labor hours.

Columns 3 to 13, from the left, give the actual labor costs in dollars per unit of installation, at various hourly wage rates.

When calculations are being made for an hourly wage rate that doesn't correspond to any of the rates listed in Columns 3 to 13, the user may multiply the number of hours in Column 2 by 100 and this will give the labor cost based on an hourly wage rate of $1 per hour. By multiplying this by the hourly wage rate that actually applies in the user's locality, the exact labor cost of the operation may be obtained. Labor costs obtained in this way will be for units, hundreds of feet, etc., as given in heading of Column 2 of the table.

The labor units covered by the tables represent direct job labor costs and do not include delivery of material to site, engineering, estimating, or any other indirect cost.

As will be noted, some of the electrical estimating tabulations to be given will be for independent operations, such as excavating, backfilling, etc. These are included for use in preparing estimates on work of a special nature not covered under a specific table heading.

Tables will appear in alphabetical order.

250 V DC - 440 V AC
HOUSING COVER OPTIONAL

CIRCUIT BREAKING PLUGS AND RECEPTACLES
DEAD END AND BASE MOUNTED
WOOD AND MASONRY
30 AMP. 3 WIRE

SIZE WIRE	SIZE POLE	SIZE HUB	HOURS PER	LABOR COST INSTALLED PER EA. @ FOLLOWING RATES $2.00	$2.25	$2.50	$2.75	$3.00	$3.25	$3.50	$3.75	$4.00	$4.25	$4.50
				DEAD END (CLAMPING NUT OPTIONAL)										
2	2	3/4	.7	1.40	1.58	1.75	1.93	2.10	2.28	2.45	2.63	2.80	2.98	3.15
2	2	1	.85	1.70	1.91	2.13	2.34	2.55	2.76	2.98	3.19	3.40	3.61	3.83
				WOOD MTD. (4 SHOES) (CLAMPING NUT OPTIONAL)										
2	2	3/4	.9	1.80	2.03	2.25	2.48	2.70	2.93	3.15	3.38	3.60	3.83	4.05
2	2	1	1.1	2.20	2.48	2.75	3.03	3.30	3.58	3.85	4.13	4.40	4.68	4.95
				CONCRETE MTD. (4 SHOES) (CLAMPING NUT OPTIONAL)										
2	2	3/4	1.1	2.20	2.48	2.75	3.03	3.30	3.58	3.85	4.13	4.40	4.68	4.95
2	2	1	1.25	2.50	2.81	3.13	3.44	3.75	4.06	4.38	4.69	5.00	5.31	5.63
DIA CABLE				TYPE C P PLUGS FOR ABOVE (CLAMP NUT AND RUBBER BUSHING OPTIONAL)										
.500	.750		.45	.90	1.01	1.13	1.24	1.35	1.46	1.58	1.69	1.80	1.91	2.03
.750	1.		.65	1.30	1.46	1.63	1.79	1.95	2.11	2.28	2.44	2.60	2.76	2.93
1.000	1.188		.9	1.80	2.03	2.25	2.48	2.70	2.93	3.15	3.38	3.60	3.83	4.05

E-102-B

GROUNDING: LABOR OPTIONAL THROUGH SHELL OR SHELL & EXTRA POLE.
LABOR: INCLUDES DISSASEMBLY, DRILLING & ANCHORINGAS REQUIRED, SECURING ASSEMBLING & MAKING CONNECTIONS.

1-60

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250 V DC - 440 V AC
HOUSING COVER OPTIONAL

CIRCUIT BREAKING PLUGS AND RECEPTACLES
DEAD END AND BASE MOUNTING
WOOD AND MASONRY
30AMP.- 4 WIRE

SIZE WIRE	SIZE POLE	SIZE HUB	HOURS PER EA.	LABOR COST INSTALLED PER EA. @ FOLLOWING RATES $2.00	$2.25	$2.50	$2.75	$3.00	$3.25	$3.50	$3.75	$4.00	$4.25	$4.50
				DEAD END (CLAMPING NUT OPTIONAL)										
4	4	1"	.9	1.80	2.03	2.25	2.48	2.70	2.93	3.15	3.38	3.60	3.83	4.05
4	4	1¼"	1.1	2.20	2.48	2.75	3.03	3.30	3.58	3.85	4.13	4.40	4.68	4.95
				WOOD MOUNTED (4 SHOES) (CLAMPING NUT OPTIONAL)										
4	4	1"	1.1	2.20	2.48	2.75	3.03	3.30	3.58	3.85	4.13	4.40	4.68	4.95
4	4	1¼"	1.25	2.50	2.81	3.13	3.44	3.75	4.06	4.38	4.69	5.00	5.31	5.63
				CONCRETE MOUNTED (4 SHOES) (CLAMPING NUT OPTIONAL)										
4	4	1"	1.2	2.40	2.70	3.00	3.30	3.60	3.90	4.20	4.50	4.80	5.10	5.40
4	4	1¼	1.3	2.60	2.93	3.25	3.58	3.90	4.23	4.55	4.88	5.20	5.53	5.85
DIA.	CABLE			PLUGS - TYPE CP - FOR ABOVE (CLAMP NUT AND RUBBER BUSHING OPTIONAL										
.500	.750		.45	.90	1.01	1.13	1.24	1.35	1.46	1.58	1.69	1.80	1.91	2.03
.750	1.000		.65	1.30	1.46	1.63	1.79	1.95	2.11	2.28	2.44	2.60	2.76	2.93
1.000	1.188		.9	1.80	2.03	2.25	2.48	2.70	2.93	3.15	3.38	3.60	3.83	4.05

E-101-B

GROUNDING THROUGH SHELL
LABOR: INCLUDES DISSASEMBLY, DRILLING & ANCHORING AS REQUIRED, SECURING, ASSEMBLY & MAKING CONNECTIONS.

1-60

Electrical Estimating—III

575 V- AC
HOUSING COVER OPTIONAL

DEAD END CIRCUIT BREAKING PLUGS AND RECEPTACLES
BASE MOUNTING (ONLY)
WOOD AND MASONRY
60 AMP - 3 WIRE

SIZE WIRE	SIZE POLE	SIZE HUB	HOURS EA.	LABOR COST INSTALLED PER EA. @ FOLLOWING RATES $2.00	$2.25	$2.50	$2.75	$3.00	$3.25	$3.50	$3.75	$4.00	$4.25	$4.50
				WOOD MOUNTING (4 SHOES) (CLAMP NUT OPTIONAL)										
3	3-4	1¼"	.85	1.70	1.91	2.13	2.34	2.55	2.76	2.98	3.19	3.40	3.61	3.83
3	3-4	1½"	.95	1.90	2.14	2.38	2.61	2.85	3.09	3.33	3.56	3.80	4.04	4.28
				CONCRETE MOUNTING (4 SHOES) (CLAMP NUT OPTIONAL)										
3	3-4	1¼"	1.1	2.20	2.48	2.75	3.03	3.30	3.58	3.85	4.13	4.40	4.68	4.95
3	3-4	1½"	1.3	2.60	2.93	3.25	3.58	3.90	4.23	4.55	4.88	5.20	5.53	5.85
DIA.	CABLE			DEAD END PLUGS FOR ABOVE (CLAMP NUT AND RUBBER BUSHING OPTIONAL)										
.500	.750		.45	.90	1.01	1.13	1.24	1.35	1.46	1.58	1.69	1.80	1.91	2.03
.750	1.000		.65	1.30	1.46	1.63	1.79	1.95	2.11	2.28	2.44	2.60	2.76	2.93
1.000	1.188		.9	1.80	2.03	2.25	2.48	2.70	2.93	3.15	3.38	3.60	3.83	4.05
1.188	1.375		1.1	2.20	2.48	2.75	3.03	3.30	3.58	3.85	4.13	4.40	4.68	4.95

E-102-B

GROUNDING: LABOR OPTIONAL THROUGH SHELL OR SHELL & EXTRA POLE.
LABOR: INCLUDES DISSASEMBLY, DRILLING & MOUNTING, MAKING CONNECTIONS & REASSEMBLY

1-60

Electrical Estimating—III

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News of the industry

edited for Southern readers

NEMA set to spearhead Medallion home program

NATIONAL responsibility for administration of the Medallion Home Program will be assumed this year by the National Electrical Manufacturers Assn., it was announced recently in Atlantic City by Joseph F. Miller, NEMA managing director.

NEMA will provide headquarters staff to make sure that standards set or revised by local utilities meet established minimums, to provide promotional material, to make available to participating utilities a continuing supply of Gold and Bronze Medallions, and to prevent unauthorized use of the Medallions.

Initiated by the Live Better Electrically Project in January, 1958, the program has established industry standards for appliances, lighting and wiring in new and modernized homes. Planned to serve as a national framework for locally-sponsored activities, the program gives home buyers and owners a recognizable hallmark, the Medallion, attesting to a home's electrical livability.

The Medallion Home Program is currently spearheaded at the local level by over 300 power suppliers, who are exclusively empowered to award Medallions to qualifying homes in their service areas. Industry surveys indicate that over 170,000 new homes have been certified for either Bronze or Gold Medallions during 1958 and 1959.

Bronze Medallion Home standards require as a minimum that homes be equipped with (1) an electric range and three other major appliances; (2) Light for Living; and (3) Adequate Wiring for plenty of Housepower.

Gold Medallions are awarded to homes that excel electrically. A key feature of such total-electric homes is electric house heating.

Georgia Power adopts wiring promotion plan

A REVOLUTIONARY new plan designed by the Georgia Power Company to help eliminate the serious to help eliminate the serious problem problem of inadequate wiring has been approved by the Georgia Public Service Commission. Inadequate wiring in recent years has denied many citizens the use of modern electrical appliances in the home.

"Far too many homes," said John J. McDonough, power company president, in explaining the proposal, "still are being constructed with wiring insufficient to handle modern-day demands. We feel the additional cost of good wiring is deterring many contractors and homeowners from building homes with enough power outlets and good wiring to meet today's requirements."

The power company proposes to pay a large share of the cost of installing heavy-duty service entrance wiring in residences on its lines. The payments will be made to the electrical contractors doing the work, and the wiring will be the property of the company. A customer, to qualify, must install certain circuits of his own, as well as certain designated appliances that require the heavy-duty wiring.

"The service entrances for which we will make installation and equipment payments to electrical contractors," Mr. McDonough said, "will definitely be of a capacity to meet not only today's needs, but those of the future as well."

Company engineers have estimated the plan will benefit thousands of Georgians now unable to use such appliances as electric water heaters, ranges and clothes dryers because of inadequate residential wiring.

The utility official reported that both existing residences and homes to be constructed would be eligible under the plan. Because the plan has never before been undertaken, the company is asking approval for a trial period of three years.

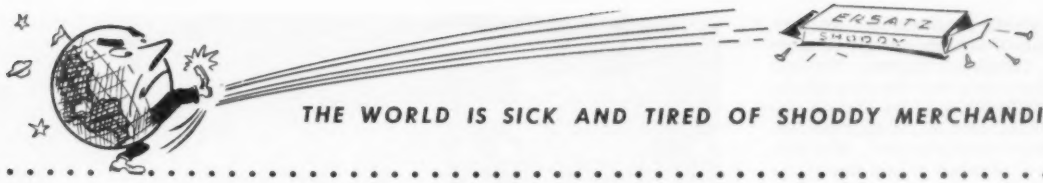
Will named chairman of VEPCO board

THE BOARD of directors of the Virginia Electric and Power Company has elected Erwin H. Will as chairman and chief executive officer. Donald C. Barnes, present chairman of the board, will become honorary chairman.

Mr. Will began his career with Vepco in 1922, occupying various positions until 1950, when he was elected vice-president. He was elected president in 1956, and became vice-chairman of the board of directors and chairman of the Executive Committee in 1958.

An active leader in civic affairs, he is a member of the Board of Visitors of Virginia Polytechnic Institute and of the Conservation and Economic Development Commission of

GEORGIA POWER ACCEPTS NEW DESIGN HEATER—C. W. Warner, Valdosta vice-president, Georgia Power Co., left, purchased the first of a new line of electric heaters made by Thermway Industries, Inc., at Hahira, Ga. The heating equipment firm's president, Martin Dyke, III, is at right. The heaters are manufactured by a new process. The electric conductor is sprayed on an aluminum panel, which is separated from the metallic circuit by a coating of high dielectric strength porcelain acting as an insulator.

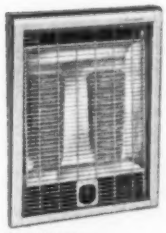


THE WORLD IS SICK AND TIRED OF SHODDY MERCHANDISE

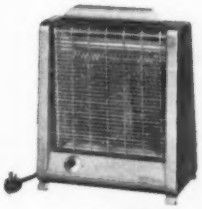
happy, satisfied customers

boost your business more than anything else

CAVALIER
ELECTRIC BASEBOARD
115 V. Duplex Outlets
Built-in Thermostat
End Caps • Corner Piece

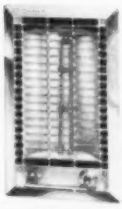


CAVALIER
WALL INSERT
1 to 5 KW



CAVALIER PORTABLE
2, 3, 4 KW

CAVALIER
CABLE
HEAT



CAVALIER BATHROOM
Automatic and
non-automatic
120 and 240 volt

Cavalier...
your assurance of Highest Quality

CAVALIER heating equipment has the genuine quality that sells, pleases customers and eliminates costly service calls.

CAVALIER has a complete line, and backs its products with written guarantees.

CAVALIER heating equipment is soundly engineered, thoroughly tested and built for long life. Although repair parts are rarely needed, they are promptly available at reasonable cost.

CAVALIER keeps within efficient trade channels, and works to assure business-like profits for distributor and contractor.

CAVALIER is nationally advertised and backs its highest quality products with complete sales and merchandising helps which are available on request.

ELECTRIC HEATING DIVISION **CAVALIER CORPORATION** CHATTANOOGA 2, TENNESSEE

OVER 90 YEARS
OF QUALITY PRODUCTS

FIRST *in quality construction*
in engineering advances
in safety
in sales making features

Virginia. He is president of the Virginia State Chamber of Commerce, and the Carolinas-Virginia Nuclear Power Associates, Inc. He is a director of the Chesapeak and Ohio Railway Company and of the Central National Bank of Richmond. He also serves as a member of the Executive Committee and director of the National Association of Electric Companies.

District 7 AIEE sets 1960 meet in Houston

HOUSTON's Shamrock Hilton Hotel will be headquarters for the South West District 7 meeting of American Institute of Electrical Engineers on April 4-6, 1960. Eighty speakers will present papers covering ten major fields of interest, in a program keyed to the theme "Electricity—Pacemaker of Industrial Growth in the Great Southwest." Inspection trips to local industries and entertainment for ladies are additional program highlights.

Line products company promotes three men

TO EFFECT closer liaison with customers and to improve technical and sales service in the field, three personnel advancements at Preformed Line Products Company have been announced by Edmund H. Brown, vice-president-sales:

Max A. Lekson to manager, telephone products sale, with headquarters at 5349 St. Clair Avenue, Cleveland, Ohio. Mr. Lekson will also serve as manager, special industry sales, supervising the introduction of Preformed products into industries other than power and communications.

Kenneth R. Miller to district manager of sales—Western Area, with headquarters located in the Preformed plant at 600 Hansen Way, Palo Alto, Calif. Mr. Miller will coordinate sales and service west of the Mississippi River.

Fred J. Lekson to district manager of sales, Eastern Area. He will coordinate sales in the New England and Atlantic states. At present, Mr. Lekson will operate from Cleveland but will soon establish headquarters in the East.

Safety conference set for 14 states in March

THE ANNUAL 14-state Southern Safety Conference and Exposition has been slated for March 6-8, 1960, W. L. Groth, executive director disclosed recently.

The event will be held at the Robert Meyer and George Washington Hotels in Jacksonville, Fla. Included in the conference will be exhibits on safety items, plus 16 sectional programs on special safety subjects.

Further information is available from Mr. Groth, P. O. Box 8927, Richmond 25, Va.

FEDERAL PACIFIC PUTS SHOW ON THE ROAD—An eight month, 10,000 mile tour is currently showing electrical men across the nation what Federal Pacific Electric Company, of Newark, N. J., is doing in the fields of electrical control, distribution, and power equipment. Featured as a "Power Parade," the display is being set up in the special trailer van shown above. It is appearing in more than 30 cities for a three-day to one-week stopover in each.

NEMA names MacDonald 1960 association head

N. J. MACDONALD, of Elizabeth, N.J. president of the Thomas & Betts Co. was elected president of the National Electrical Manufacturers Association in Atlantic City, N. Y. recently at the closing session of NEMA's 33rd annual convention.

Mr. MacDonald, a vice-president of the association, succeeds J. L. Singleton, of Milwaukee, Wis., senior vice-president, Industries Group, Allis-Chalmers Manufacturing Co.

W. C. Wichman, of Chicago, Ill., vice-president of General Electric Co., and general manager of the company's Hotpoint Division, was elected vice-president. A. D. R. Fraser, of Rome, N. Y., president of Rome Cable Corp., was elected treasurer.

The new NEMA president is also chairman of the industry's annual observance, National Electrical Week, and formerly served as chairman of the Executive Committee of the National Wiring Bureau, an industry-wide organization interested in furthering the adequate wiring of homes, commercial and industrial structures.

Max Lekson

Kenneth R. Miller

Fred Lekson

S&C Electric realigns engineering, research

S&C ELECTRIC CO., producer of high-voltage switchgear, has separated its research and engineering functions, according to John R. Conrad, S&C president.

Sigurd I. Lindell becomes vice-president of research and engineering, while Charles H. Baker becomes

J. J. Mikos H. H. Fahnoe S. I. Lindell C. H. Baker

engineering director. John J. Mikos becomes research manager, and Harold H. Fahnoe becomes engineering manager.

The Research operation will extend and expand S&C's basic knowledge in the company's special field of high-voltage circuit interruption, and will create prototypes of new products of exotic design. The Engineering operation will carry the exotic prototypes into full production, will develop and design new products of orthodox types, will improve existing products, and will maintain production standards.

Outstanding engineers receive AIEE citation

THE BOARD of directors of the American Institute of Electrical Engineers has elevated several members to the grade of Fellow for outstanding contributions to the profession, N. S. Hibshman, executive secretary, has announced. Those from the South so honored and their citations are:

Edwin C. Ballman, chairman of the board, Baldor Electric Co., St. Louis, Mo., "For contributions to design and fabrication of small electric motors."

Willard R. McCarty, supervisor of electrical engineering, department of research and development, Wagner Electric Corp., St. Louis, Mo., "for contributions to techniques of high voltage and corona tests of power transformers."

Ralph E. Thornton, superintendent of engineering, Oklahoma Gas and Electric Co., Oklahoma City, "for contributions to planned expansion of a utility power system."

Utility company leader retires in Baton Rouge

HAROLD C. LEONARD, of Baton Rouge, executive vice-president of Louisiana operations and a director of the Gulf States Utilities Co., retired recently, completing 40 years of service in the utility industry. Having served as president of both the Baton Rouge Electric Company and the Louisiana Steam Generating Corporation, Mr. Leonard became vice-president of Gulf States Utilities Company in 1938, when the latter company incorporated the other two. He holds the Lockett Award from the Louisiana Engineering Society.

Anaconda cable engineer retires after 48 years

AFTER 48 YEARS of service with the electrical wire and cable industry, Samuel J. Rosch has retired from active duty with Anaconda Wire and Cable Co.

As consulting cable engineer for Anaconda Wire and Cable, he was "ambassador-at-large" for the company, providing customers with assistance and counsel. In his extensive travels, he talked on scientific developments in the wire and cable industry to more than 800 audiences. He translated difficult engineering language into simple, understandable terms—an ability which made his talks as exciting to non-technical groups as to highly-trained engineering specialists.

Rosch has been president of the Insulated Power Cable Engineers Association (IPCEA). He is a life member of IPCEA and the American Institute of Electrical Engineers, and has received several citations from the United States Government for his wartime accomplishments. His invention for applying carbon black

Dates Ahead

2nd Southwest Heating and Air Conditioning Exposition, Memorial Auditorium, Dallas, Texas, Feb. 1-4, 1960.

Missouri Valley Electric Association, Industrial and Commercial Sales Conference, President Hotel, Kansas City, Mo., Feb. 8-9, 1960.

Southern Safety Conference and Exposition, Robert Meyer and George Washington Hotels, Jacksonville, Fla., March 6-8 1960.

National Electrical Industries Show, New York Coliseum, New York City, N. Y., March 6-9, 1960.

1st National Electric House Heating Exposition, Sherman Hotel, Chicago, Ill., March 21-23, 1960.

Southeastern Electric Exchange, Annual Conference, Boca Raton Hotel and Club, Boca Raton, Fla., March 21-23, 1960.

Alabama Electrical and Electronic Exposition, Birmingham City Auditorium, Birmingham, Ala., March 21-23, 1960.

IAEI, Mississippi Chapter, King Edward Hotel, Jackson, Miss., March 28-29, 1960.

IAEI, Virginia Chapter, Mariner Hotel, Virginia Beach Va., April 4-5, 1960.

AIEE, South West District, Annual Meeting, Shamrock Hilton Hotel, Houston, Texas, April 4-6, 1960.

Southeastern Electric Exchange, Engineering and Operation Section Conference, Roosevelt Hotel, New Orleans, La., Apr. 7-8, 1960.

Protective Relay Conference, Texas A & M College, College Station, Tex., April 11-13, 1960.

IAEI, Ellis Cannady Chapter, Carolina Hotel, Raleigh, N. C., April 12-13, 1960.

Missouri Valley Electric Association, Engineering Conference, President Hotel and Municipal Auditorium, Kansas City, Mo. Apr. 20-22, 1960.

IAEI, Alabama Chapter, Admiral Semmes Hotel, Mobile, Ala., April 25-26, 1960.

IAEI, Tennessee Chapter, Andrew Jackson Hotel, Nashville, Tenn., May 2-3, 1960.

IAEI, Florida Chapter, George Washington Hotel, West Palm Beach, Fla., May 5-7, 1960.

IAEI, Texas-Louisiana Joint Meeting, Seven Chapters, Hotel Marshall, Marshall, Texas, May 6-7, 1960.

IAEI, Georgia-South Carolina Chapters, Joint Meeting, DeSoto Hotel, Savannah, Ga., May 9-10, 1960.

IAEI, Southern Section, Rice Hotel, Houston, Texas, Oct. 17-19, 1960.

tapes to electrical conductors is said to be one of the outstanding developments for improving the serviceability and life of paper-lead power cables.

Kearney Corporation elects new president

CHARLES WENNER has been elected president of the James R. Kearney Corp. of St. Louis. Mr. Wenner is a former vice-president and general manager, and more recently, president of the James R. Kearney Corporation of Canada, Ltd.

The new president began his career in the sales department of the parent

Charles Wenner

company in 1929. In 1951 he was named general manager and vice-president of the Canadian plant, and in 1958 he was elected president of the Canadian company to succeed Walter Heinrich.

Wenner also served on the board of directors of the Canadian company, and on the board of directors of the James R. Kearney Corp., St. Louis.

New agency to serve Memphis trade area

JIM CLARY, former sales manager for Light & Power Utilities Corp., Memphis, recently announced the formation of an agency to represent

Jim Clary

electrical manufacturers in the Memphis trade area. The agency will operate under his name at 4943 Welchshire and will represent Light & Power, a manufacturer of fluorescent and incandescent light fixtures, and other lines.

Clary had previously been associated with the Memphis Light, Gas & Water Division as lighting engineer, and was a salesman with Graybar Electric Company before joining Light & Power.

Manufacturers appoint new representatives

APPOINTMENT OF SIX manufacturer representative firms in the South and Southwest was recently announced by Sun-Tron Corp., Chicago, manufacturer of electric heating equipment.

According to Roger A. Weiler, general manager of the firm, the appointments were all made during the last few months. They are as follows:

Charles E. Corrigan, Jr., New Orleans, La., covering the entire state.

Ken. H. Hill, Mount Dora, Fla., covering all of Florida except Tallahassee and West.

Kuzell and Company, Decatur, Ga., covering the entire state.

C. F. Thomas, St. Louis, Mo., covering Arkansas, Central and Southern Illinois and all of Missouri except the Western part.

Robert C. Chapman, Charlotte, N. C. covering that state only.

The Hodges Company, Dallas, Texas, covering Texas and Oklahoma.

* * *

Jerry Gatz

ADVANCE TRANSFORMER CO., of Chicago, Ill., has announced the appointment of Jerry Gatz as their full-time representative in Ohio (except Cincinnati), Pittsburgh, and West Virginia.

* * *

I. LEVIN & ASSOCIATES, INC., of New Orleans, has been appointed to represent E. M. Wiegmann & Co., of Freeburg, Ill., in the states of Louisiana and Mississippi, plus Mobile, Alabama, and Pensacola, Florida. The Levin organization will warehouse Wiegmann products including switching outlet boxes, cutout and pull boxes, duct, special enclosures, service entrance equipment, and safety switches.

* * *

A. J. Moss

A: J. Moss, who was formerly associated with General Electric Supply Co., is now covering the South Alabama-West Florida territory for Gregory-Salisbury & Co. He maintains his office at 26 So. Lafayette Street in Mobile.

* * *

THE GENERAL SWITCH CO., a subsidiary of Crescent Petroleum Corp., announces the appointment of Jack A. Clark as its Louisiana and Mississippi salesman in conjunction with

Jack A. Clark

the opening of a new office and warehouse at: 1917 Julia Street, New Orleans, La., Jackson 2-6256.

Mr. Clark, a graduate of the Alabama Polytechnic Institute, has had extensive experience with the General Switch line, having sold this equipment to the electrical contractors and wholesalers in the New Orleans area.

* * *

TRADE SERVICE PUBLICATIONS, INC., publishers of Wholesale Electrical Price Book Services have announced the appointment of Henry Czech as their representative in the state of

Florida, exclusive of Jacksonville and the Panhandle.

For many years Mr. Czech was associated with Westinghouse Electric Supply Co. and upon his retirement in 1955 was the manager of WESCO's Central Region.

During the past four years Mr. Czech was the managing director of the Midwest Electrical Distributor's Assn.

* * *

NEW FIELD ASSIGNMENTS in the South for Line Material Industries have been announced by E. W. Williams, marketing vice-president. They are:

A. O. Engen, lighting engineer, Kansas City office, serving customers in Kansas, Missouri, Iowa, Illinois, and parts of Nebraska and Indiana.

J. C. Kurt, field engineer, Joplin office, handling customers in Arkansas, Missouri, and Oklahoma.

J. H. Brewer, field engineer, Pine Bluff office in Arkansas, visiting customers in that state and Missouri. He is assuming the position vacated by H. R. Rowe, who is now manager of capacitor sales and service at Central plant in South Milwaukee, Wis.

E. S. Harris, apparatus engineer, Atlanta office, visiting customers in Georgia, Florida, and the Carolinas.

R. Crick, field engineer, office in Jacksonville, Florida, serving customrs in Georgia and Florida. Crick was formerly at the Charlotte, North Carolina office.

Men moving up in the industry

EARL N. PICKER has been named sales promotion manager for Day-Brite Lighting, Inc., St. Louis, in a recent announcement by Gordon Wells, the lighting firm's general manager of sales.

Picker joined Day-Brite in 1945

Earl N. Picker

as a draftsman in the engineering department. He later transferred into the advertising department as an artist, and was eventually named art director. In this capacity, he also designed and supervised the building of company trade show displays.

PVC
ROYALOK

Caps and Connectors interlock with a twist of the wrist . . . give you rugged, positive, fail-proof power connections.

Unbreakable molded vinyl bodies—can't crack, chip, or break . . . hold blades and contacts solidly in place. Resistant to acid, oil, and grease.

Safer, stronger construction— Dead-front caps eliminate nuisance of fiber washers and dangers of exposed conductors. Internal barriers separate conductors. One-piece connectors have heavy brass double-wipe contacts locked in solid vinyl.

ORDER FROM YOUR WHOLESALER, OR WRITE FOR CATALOG 2-58-4.

A Broad Line of ROYALOK Interlocking* Devices

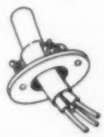
2-Wire Polarized	3-Wire Polarized Grounded	4-Wire Grounded
10 Amp — 250V 15 Amp — 125V 20 Amp — 250V Dead-front caps . . . one-piece connectors	10 Amp — 250V 15 Amp — 125V 20 Amp — 250V 10 Amp — 600V Dead-front caps . . . one-piece connectors	20 Amp — 250V 10 Amp — 600V Dead-front caps . . . one-piece connectors

*Fit all standard interlocking devices

QUICK, CLEAN WIRING 3 Simple Steps!

1. Remove cord grip plate by loosening plate screws (they can't fall out).

2. Insert cord thru clamp, strip conductors and connect to terminals.



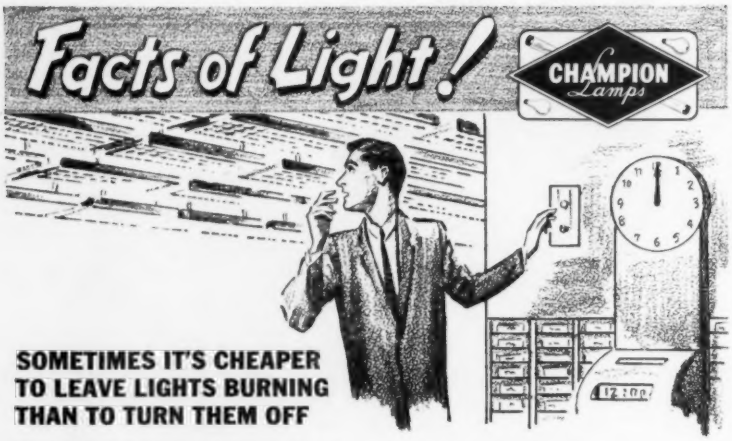
3. Replace grip plate, tighten screws — that's all!

ROYAL ELECTRIC

... an associate of IPC

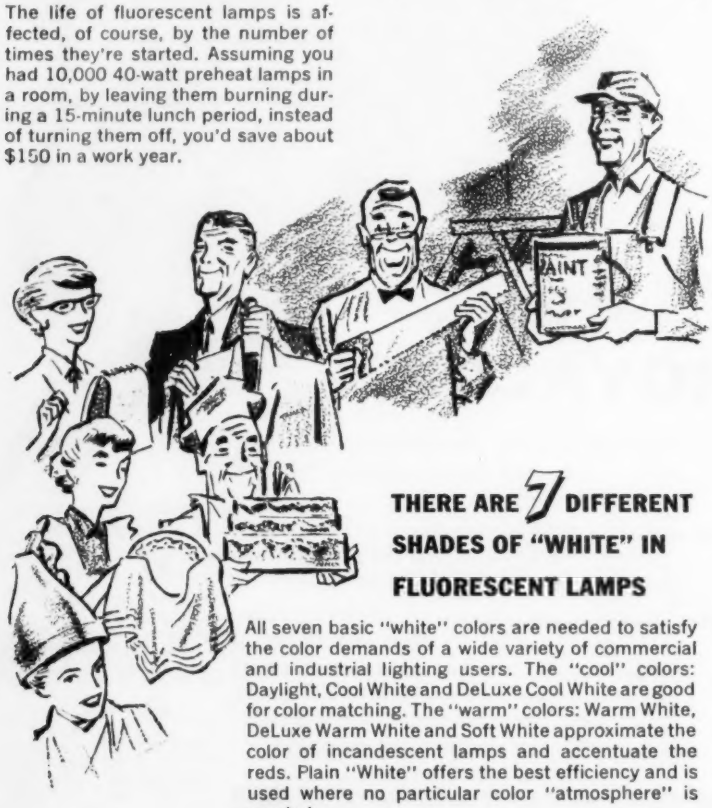
ROYAL ELECTRIC CORPORATION
PAWTUCKET, RHODE ISLAND

REPRESENTATIVES:
Cary Chapman & Co., Atlanta—New Orleans—Greensboro—Birmingham
Suchman & Coulters, Inc., Miami
NuRo Company, Houston—Dallas—San Antonio



SOMETIMES IT'S CHEAPER TO LEAVE LIGHTS BURNING THAN TO TURN THEM OFF

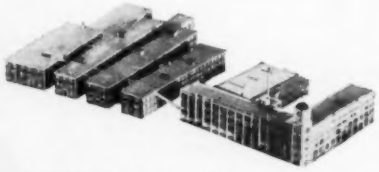
The life of fluorescent lamps is affected, of course, by the number of times they're started. Assuming you had 10,000 40-watt preheat lamps in a room, by leaving them burning during a 15-minute lunch period, instead of turning them off, you'd save about $150 in a work year.



THERE ARE 7 DIFFERENT SHADES OF "WHITE" IN FLUORESCENT LAMPS

All seven basic "white" colors are needed to satisfy the color demands of a wide variety of commercial and industrial lighting users. The "cool" colors: Daylight, Cool White and DeLuxe Cool White are good for color matching. The "warm" colors: Warm White, DeLuxe Warm White and Soft White approximate the color of incandescent lamps and accentuate the reds. Plain "White" offers the best efficiency and is used where no particular color "atmosphere" is needed.

3,000 DIFFERENT TYPES OF LAMPS ALL PRODUCED IN 1 PLANT under 1 STANDARD OF QUALITY CONTROL



Champion has continuously produced top quality lamps since 1900. All research, development, manufacturing and test facilities are concentrated in one modern plant . . . all dedicated to provide you with light at lowest cost.

CHAMPION LAMP WORKS, Lynn, Massachusetts

CHAMPION INCANDESCENT-FLUORESCENT • *YOUR BEST BUY IN LAMPS*

CHARLES E. COOK has been named director of personnel, insurance and safety for Southwestern Electric Power Co., it was announced by J. Robert Welsh, president.

Cook started working for Southwestern as a junior engineer in Sep-

Charles E. Cook

tember, 1948, while attending the University of Arkansas in Fayetteville.

Upon receiving his B.S. degree in electrical engineering in 1949, he was named a distribution engineer. He remained in Fayetteville until 1952 when he transferred to Shreveport, La., as a safety engineer and later was elevated to the position of assistant director of personnel and safety.

* * *

ROBERT B. AMES has been named manager-marketing at General Electric's Medium Transformer Department in Rome, Ga., David B. Lawton, department general manager, announced recently.

A native of Dover-Foxcroft, Me., Mr. Ames joined the General Elec-

Robert B. Ames

tric Company in July, 1950, after being graduated from the University of Maine with B.S. and M.S. degrees in electrical engineering.

He has held assignments in market research and product planning, as well as various sales areas.

* * *

THE APPOINTMENT OF Philip Scharf, Jr. as promotion manager-panelboards and switchboards has been an-

nounced by Merle P. Spurrell, director of sales of the BullDog Electric Products Division of I-T-E Circuit Breaker Company.

A 19-year veteran with BullDog, Scharf has served in various capacities in the engineering and sales sections of the company. He has been manager of order services since 1951.

Scharf majored in electrical and mechanical engineering at the Lawrence Institute of Technology, Detroit.

* * *

ALFRED G. BOSANKO has been elected by the board of directors to the newly-created post of vice-president, Indoor Distribution, of I-T-E Circuit Breaker Co., Philadelphia, Pa.

In this new position, Bosanko, a director of I-T-E since 1957, will be

Alfred G. Bosanko

responsible for the overall operations of I-T-E divisions and subsidiaries which produce indoor distribution products.

He has been engaged in the electrical industry for more than 35 years.

* * *

GULF STATES UTILITIES Company of Louisiana has announced the election of Harold E. Brown to the position of vice-president, responsible for Baton Rouge Division operations.

Mr. Brown was formerly division manager in Baton Rouge, a position he has held since 1956.

Brief news notes of manufacturers

ONE COMPANY'S ANSWER to the combined demands of the nation's construction boom and the consumer's growing desire for electrical living, was presented recently when the Anchor Manufacturing Co., Manchester, N. H. (a division of Basic Products Corporation) held the official opening of its new plant in Bradenton, Fla.

Faced with a rapidly-rising demand for its electrical meter mounting and testing equipment (widely used in the electrification of homes, offices, and factories), the company

TOGGLE BOLTS

TWO-WING SPRING TYPE

FINE QUALITY and SKILLFUL WORKMANSHIP are the distinguishing features of Arro Toggle Bolts.

This well made toggle bolt makes fastening to tile, plaster, wall board, or any type of hollow construction, quick and sure. Its lively spring, when released, spreads the steel wings into open position —tightening develops maximum holding power.

Used extensively by electricians, plumbers, decorators, maintenance men, sign men and many other tradesmen.

SCREW HEAD STYLES

TUMBLEHEAD GRAVITY TYPE

Falls into open position to fasten work securely against hollow walls.

RIVETED HEAD STUD BOLT TYPE

Falls into open position by gravity.

THE TRADE ARRO MARK LINE OF MASONRY ANCHORING AND DRILLING DEVICES

A-C-E EXPANSION SHIELD

MACHINE SCREW ANCHOR

ARRO-CORE MASONRY DRILL

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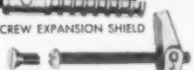

TWO WING TOGGLE BOLT

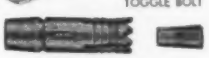
LEAD SCREW ANCHOR

RUBBERGRIP DRILL POINT HOLDER

TUMBLE TYPE TOGGLE BOLT

JUTE PLUG

LITTLE MAJOR TURNBUCKLE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has built a 21,500 square foot plant which can be expanded to four times its present size. The new plant is already in production.

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* * *

A. A. SNOWBALL, vice-president in charge of sales of Pittsburgh Standard Conduit Co., Verona, Pa., has been elected chairman of the Rigid Steel Conduit Section of National Electrical Manufacturers Association. He will head the Rigid Steel Conduit group for 1960. A native of Niles, Ohio, he has been a resident of suburban Pittsburgh since 1946 when he joined Pittsburgh Standard as sales manager. Mr. Snowball graduated from Amherst in 1937.

* * *

A NEW FACILITY to repair and rebuild all kinds of electrical equipment for industry will open in Jacksonville, Florida, General Electric Company has announced.

The new shop will serve industrial firms and utilities in more than 50 counties of northern Florida and southern and eastern Georgia.

* * *

PLANS for a new plant that will nearly double the manufacturing capacity of the Heinemann Electric Co., Inc., of Trenton, N. J., have been announced by B. A. Berlin, president. The firm is a major producer of circuit breakers and overload and time-delay relays for various types of equipment protection and control.

The new plant will exceed 100,000 square feet, and will be located off Brunswick Pike in Lawrence Township, N. J., just two miles away from the company's present location.

* * *

ENTRANCE of The Electric Autolite Company into the industrial battery market was made today with the completion of its purchase of the assets of C & D Batteries, Inc. of this city for an undisclosed sum. Announcement of the transaction was made jointly by Robert H. Davies, president of Autolite, and John F. Rittenhouse, president of C & D.

* * *

IN A SWEEPING MOVE marking complete replacement of all former facilities, the country's oldest manufacturer of electrical fuses now is in full-scale production in its new, streamlined 56,880-square-foot plant.

Signalling the end of a two-year, two-stage modernization-by-replacement program, the move was made by The Chase-Shawmut Co., Newburyport, Mass., a subsidiary of I-T-E Circuit Breaker Co., Philadelphia.

Technical books

Code changes

"Analysis of 1959 National Electrical Code," by Howard Michener. Published by National Electrical Manufacturers Assoc., 155 East 44th St., New York 17, N. Y., 107 pages, 50¢.

Valuable for its analysis and detailed interpretation, this booklet should be of special interest to contractors, inspectors, manufacturers, power suppliers, and engineers in the electrical industry.

The 1959 Code is a complete revision of the 1956 edition, and includes such data as new classifications for portable kitchen units, new requirements for minimum service capacity in residences, and increased number of conductors in metal raceways. Howard Michener discusses these and other revisions in detail.

The author is assistant manager of the NEMA Engineering and Safety Regulations Department.

Transistor troubles

"Pin Point Transistor Troubles in 12 Minutes," by Louis E. Garner, Jr. Published by Technical Book Division, Coyne Electrical School, 1501 W. Congress Hwy., Chicago 7, Ill. 478 pages, spiral binding, $5.95.

Mr. Garner presents an entirely new technique for trouble shooting on all types of transistorized equipment. Using the Coyne Pin Point-Check Chart method, so successfully applied in three previous books, the author offers the fastest tested system for the location of troubles in radios, TV sets, Hi-Fi, hearing aids, and practically all types of hybrid and commercial equipment using transistors.

Forty-five manufacturers cooperated in furnishing data on their commercial equipment for this book. Schematics and special service data are included. Also included is a 50-page reference data section, covering wave form analysis, parameter symbols, reference directory with over 600 possible transistor changes, complete data on industrial electronic - batteries and transformers, etched circuit repair methods, and tools. Over 1,200 subjects are listed in the index with more than twice as many cross references for additional data on the subjects.

For the added benefit of the busy serviceman, the author employs three special tables in addition to the conventional type of technical book index. Table AA contains data on the trouble shooting check charts used throughout the book. Table BB covers commercial equipment service

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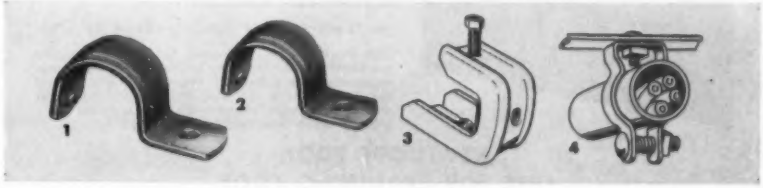

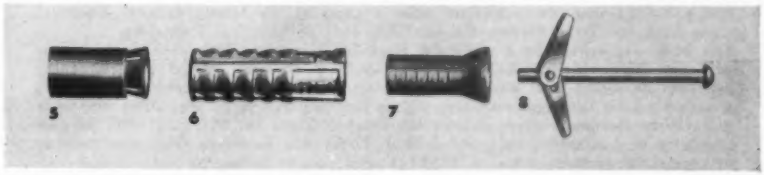

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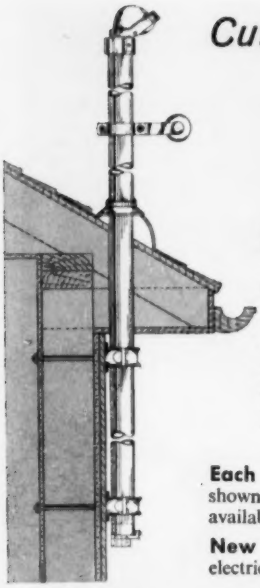

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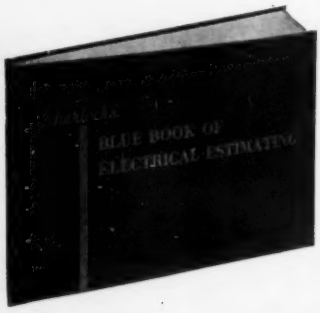

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(January 1960)

data, schematic diagrams, photos and layout diagrams, alignment tables. Table CC is a quick reference chart on transistor interchangeability, lead connections, and component specifications.

Induction motors

"Theory and Design of Small Induction Motors," by Cyril G. Veinott. Published by McGraw-Hill Book Company, Inc., 327 West 41st Street, New York 36, N. Y., 492 pages, 6 x 9, 202 illustrations, $13.50.

Here is comprehensive coverage of the engineering, application, and design procedures that must be taken into account when working with small induction motors.

Organized in four separate parts for easy reference, the book describes engineering principles and characteristics; treats theory and performance calculation methods; provides methods and formulas for analyzing a given design; and shows how to design a machine to meet specified objectives.

Engineering fundamentals of single-phase and polyphase motors—including capacitor and split-phase types—are treated in simple, nonmathematical terms. An entire section of the book is devoted to developing theory and methods of predicting the performance of an induction motor when its constants are known.

Special attention is given to the ultimate aim of design—determining the geometry of the machine and winding specifications in order to meet desired objectives. Main emphasis is on the basic theory of induction motors, and mathematics is used only as needed to explain methods and develop formulas for the use of engineers.

Printed circuits

"Printed Circuit Diagnosis Made Easy," by C. P. Oliphant. Published by Howard W. Sams and Co., 1720 East 38th Street, Indianapolis 6, Ind., 64 pages, 5½ x 8½, $1.00.

Written specifically to help solve the many problems service technicians face when they service printed circuits in television and radio chassis, this book stresses the diagnosing process. It tells how to pinpoint the trouble area and discover the defective component quickly.

In addition, it describes the best procedures to follow when only a schematic diagram is available, and it tells the correct way to interpret and use the various styles of service literature available. Sample problems illustrate each phase of the television and radio troubleshooting process.

This book will help the technician to service all types of printed board chassis in all types of equipment.

Basic electricity

"Basic Electricity and an Introduction to Electronics," by the Howard W. Sams engineering staff. Published by Howard W. Sams & Company, Inc., Indianapolis 6, Ind. 176 pages, 8½ x 11, 317 illustrations, $3.60.

This new reference-text has been specifically designed for instructional use in secondary schools, vocational-technical programs, technical and trade institutions. However, service technicians and hobbyists will find this volume an invaluable aid for the self-study of electricity and electronics.

It is a complete basic text that covers: wire and wireless communication, electrical power distribution, heating and lighting, residential and commercal wiring, industrial electricity, radiology and electrochemistry, service and industrial electronics.

A special introduction to the electronics section presents the theory and circuit applications of modern electronic components as found in the home, industry, and the field of communications. Medical applications, automation, data processing and basic military applications are also featured.

The material in this volume has been organized under the supervision of the Sams educational division so that it may be easily scheduled for various types of classes. A complete instructor's manual with suggested time schedules, answer keys, and teaching suggestions is available. Additional companion pieces, including a study guide, a shop project manual, and laboratory experiment manual, are to be published soon.

Control circuits

"Handbook of Electronic Control Circuits," John Markus. Published by McGraw-Hill Book Company, Inc., 327 West 41st St., New York 36, N. Y. 350 pages, 8½ x 11, illustrated, $8.50.

This comprehensive compilation gives industrial electronic and design engineers a selected reference to over 250 electronic circuits, each complete with values of components. From it can be obtained the salient points of a number of circuits of a given type as a guide for choosing the most promising circuit for a particular application.

Advances in the field are included to show the present state of the art of circuitry in such areas as alarm circuits, audio control circuits, computer control circuits, machine control circuits, magnetic amplifier circuits, nucleonic circuits, process control circuits, servomechanism circuits, switching circuits, and telemetering control circuits.

Each discussion covers a circuit based on equipment now in actual operation. Thus the practical usefulness of any circuit being considered for adaptation has already been proved.

This new volume is the third in a series of handbooks compiling important circuits for easy access. It extends but does not duplicate the material in the two earlier volumes, *Handbook of Industrial Electronic Circuits* and *Handbook of Industrial Electronic Control Circuits*, by Markus and Zeluff.

Audio testing

"101 Ways to Use Your Audio Test Equipment," by Robert G. Middleton. Published by Howard W. Sams and Co., 1720 East 38th Street, Indianapolis 6, Ind., 144 pages, 5½ x 8½, $2.00.

This book answers the definite need for a practical book on test equipment usage in the audio field. Much of the information it contains is new and unique. It describes many uses for special instruments such as harmonic - distortion analyzers, audio watt meters, audio VTVM's, and toneburst generators, etc.

This is not a theory or a textbook —it is a practical working handbook for the audio technician and enthusiast.

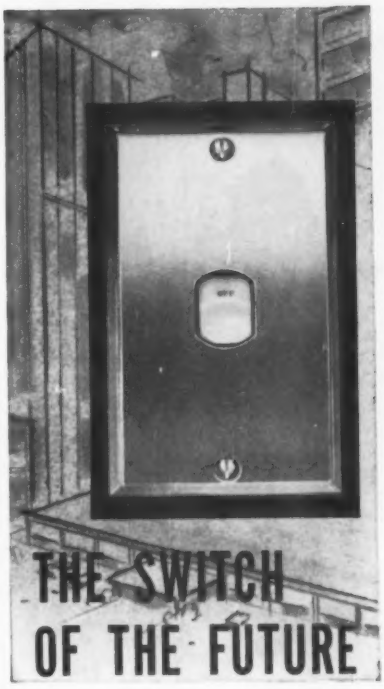
Computer applications

"Computers and People: Business Activity in the New World of Data Processing," by John A. Postley. Published by McGraw-Hill Book Company, Inc., 327 West 41st St., New York 36, N. Y., 251 pages, $6.00.

What modern computers can mean to readers whom these machines are designed to serve—such as businessmen, managers, and other non-technical people—is explained in this newly published book. It gives a realistic picture of electronic devices that can lead to entirely fresh techniques of business operation and control.

Mr. Postley provides a clear discussion of the economics of computers and explains equipment in terms that can readily be grasped by non-specialists. Compromises that the data processing specialist must make in behalf of the organization he serves are described, as well as the decision-making aspects of computers and changes that must be made by business to utilize data processing most effectively.

Future equipment and capabilities of computers are predicted, and the role that computer manufacturers should play in maximizing benefits to users is also discussed. The book treats the social problems created by modern data processing equipment and includes an illustrative review of some present and forthcoming applications of computers.



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New products

Built-in stereo-intercom ushers selective listening into homes

NuTone, Inc., Madison and Red Bank Roads, Cincinnati 27, Ohio, announces the introduction of built-in stereo-intercom high-fidelity music system for homes.

It is a complete entertainment and communications system with stereo, record changer, AM/FM radio tuner, two amplifiers (in a single chassis), all the inside and outside speakers desired, a built-in record storage cabinet or tape deck, plus high-fidelity intercom. The built-in components save the cost and clutter of all the cabinets many stereo systems require.

This major new product from Nu-Tone provides stereo or high fidelity sound throughout the house, instead of in just one room. Stereo radio broadcasts can be enjoyed with a single AM/FM tuner. Each room has selective listening. For instance, two radio programs can be on at the same time or records on channel A and FM on channel B.

The intercom is available at all times for room-to-room communication and door answering. Music or radio are silenced automatically when the intercom is operated.

Write P-113 on reply card, pg. 17

Outdoor luminaires give power, simplicity of use and installation

Lawn-Glo luminaires, a new approach to modern outdoor residential lighting, are being manufactured by Line Material Industries, 700 W. Michigan, Milwaukee 1, Wis. They provide a large area of illumination, ideal for lighting drives, and recreational areas. Furnished with or without an integral photoelectric control,

the fixtures are particularly suited for security lighting.

Lawn-Glo fixtures may be used with incandescent lamps rated through 150 watts. A utility outlet is built into the slip-fitter base for plugging in other electrical appliances.

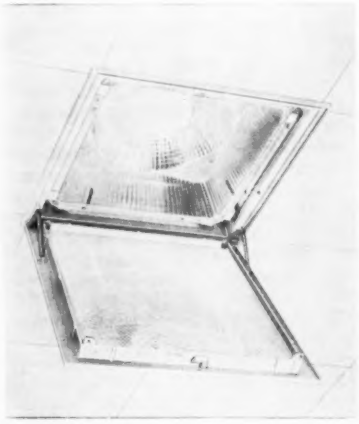
Simplicity of installation and maintenance is a primary feature of the Lawn-Glo luminaire. Accessibility of the luminaire interior is facilitated by a plug-in lamp-holder assembly which can be lifted off the top of the fixture for lamp replacement.

Write P-114 on reply card, pg. 17

Recessed luminaire, Controlens, opens via hinged ceiling door

Holophane Co., Inc., 342 Madison Ave., New York 17, N. Y., announces the new F-1565 series, a recessed luminaire, Lo-Brite, concave Controlens for 12-inch tile construction. It features a Holophane mechanical innovational — PAL (positive automatic latching).

The luminaire features a die-cast, corrosion-resistant cast zinc door and trim designed to fit into a 12-inch ceiling opening in a tile or plaster



ceiling. Two mounting rails are furnished eliminating the need for extra plaster frames.

Relamping is made easy with PAL. The door is simply opened by pushing up against the Controlens which releases the latching mechanism allowing the door to swing open slowly and smoothly. The lamp can be serviced from the floor with a standard lamp changer pole.

Write P-115 on reply card, pg. 17

Extension cord connector locks plugs into position

A LOCK-ON extension cord that locks to any standard cap is now being manufactured by Eagle Electric Mfg. Co., Inc., 23-10 Bridge Plaza South, Long Island City 1, N. Y.

Simple to use, the cap is merely inserted into the extension cord's

lock-on connector and is automatically locked in tight. Tugging, yanking will not disengage the cap. Poor connections and power interruptions are eliminated.

The cap remains locked in until released by pressing both buttons of the lock-on cord connector. With this device, everyone can lock on their power tools, lawn mowers, hedge cutters, etc.

Write P-116 on reply card, pg. 17

Surface and dome Unilet covers offer explosion, dust protection

APPLETON ELECTRIC CO. 1701-59 Wellington Ave., Chicago 13, Ill., has announced a completely new series of explosion-proof and dust-tight "GUB" Series threaded unilet covers.

These covers are now available in two different types, surface and dome. The surface type is best suited for small connection terminals or plain junctions. The dome type covers should be applied when large, oversized connection blocks or heavy wires are to be used. The dome covers allow wires to be pulled out far beyond the junction of the unilet body opening for easy accessibility with-

out the problem of cramming the wire back in when work has been completed.

Additional advantages to the dome cover is that it allows long terminals to protrude from the junction area.

Write P-117 on reply card, pg. 17

Wiring devices aid installation with stripper, terminal lock

THE NEWEST INNOVATION of General Electric Co., 95 Hathaway St., Providence 7, R. I., switches and outlets with built-in automatic wire stripper and Pressure-Lock terminals, offer another installation convenience for electrical contractors, making their work easier than ever before. They eliminate the need for separate wire strippers that are frequently mislaid or lost and expensive to replace.

With these new devices, all that is required to strip any AWG #12 or

#14 wire is to insert the wire into the stripper opening to the depth of the mounting screw which is held captive in the device. A simple pull and insulation is stripped clean to the exact length required for the patented G-E Pressure-Lock terminals. In just seconds, stripped conductors are easily pushed into the Pressure-Lock terminals and firm, vibration resistant electrical connections are made automatically.

Write P-118 on reply card, pg. 17

Mechanically held contactors have small size, big efficiency

THE ARROW-HART & Hegeman Electric Co., Industrial Control Division, 103 Hawthorn St., Hartford 6, Conn., announces the production of a new line of type CRA-MH mechanically held contactors. Supplied in NEMA sizes 0 through 5, with 2, 3 or 4 poles, these contactors fea-

*Pole-setting attachment optional.

ARMY REPORT ON JAQUES KJ-254**

"There was a performance test on Pilot Model (Jaques Earth Auger), Model KJ-254, built by Texoma Enterprises, Inc. This test performed in accordance with Military Specification Mil-A-516B, paragraph 3.9 through 3.9.2.

"This test was performed in sandy, gravelly, red clay, hard and dry to blue silty clay at bottom of hole. Average time per hole for 25 consecutive holes was 78 seconds. Average depth of holes was 67.2 inches. Machine functioned at normal temperature."

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3. JAQUES have fewer moving parts for longer life . . . lower maintenance and operation costs . . . less "down time" . . .
4. JAQUES dig holes up to 45° angle, either side of truck . . . Patented pressure control takes strain off all parts when rock drilling . . .
5. FIRST Jaques built 29 years ago is STILL IN OPERATION!

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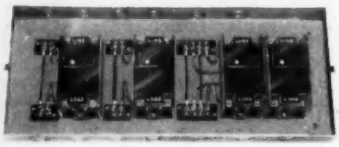

Model 402:

- Reduces house demand load by sequence dumping of heating circuits with resultant saving in electric energy charges.
- Control handles 6 electric heating circuits (4 - 15 Amperes and 2 - 25 Amperes)
- No discomfort to householder
- Approved installation with minimum labor.

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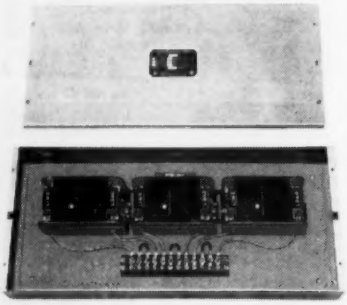

Model 261-A:

- Specially designed for small home or apartment
- Control handles 3 - 25 Ampere electric heating circuits
- Noiseless operation
- Permits reduced electricity charges with minimum discomfort to householder.

Six Models Available — Complete information will be sent on request, from

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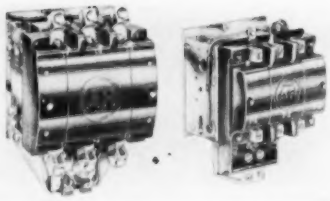
3627 Peachtree Road, N. E., Atlanta, Ga.

Division of Pioneer Electric



ture small size, light weight, straight-through front wiring, and remote-control provisions via a second coil.

Type CRA-MH contactors are electrically operated switches that are closed by the momentary energization of a coil, and then held in the closed position by a mechanical latch, instead of the electrical holding circuit usually employed. Frequently used in motor control circuits where continuity of an operating sequence must be maintained despite voltage failures or other outside interruptions, these contactors are also used to control light or power circuits in hospitals, schools, and other locations where the slight a-c hum of an electrically held contactor might be objectionable.

Since the mechanical latching device consumes no power, these contactors can be used in places where the circuit will be closed for long periods.

Write P-119 on reply card, pg. 17

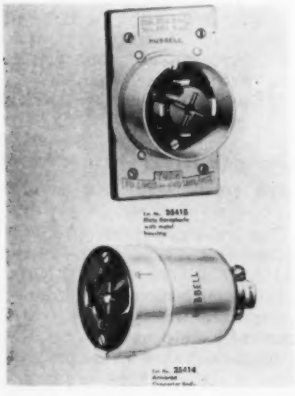
Cord grounding units extended to include four-wire circuits

HARVEY HUBBELL, INC., Box H, Barnum Station, State & Bostwick Avenues, Bridgeport 2, Conn., have introduced a complete new line of 5-wire Hubbellock devices designed for 4-wire applications requiring additional equipment ground. Rated 30 amperes, 600 volts a-c and 20 amperes, 250 volts d-c, the units include a male and a female receptacle with metal housing, and an armored cap and body.

All Hubbellock units, including these latest 5-wire additions, are ruggedly constructed for heavy-duty applications involving high cycle tools and other portable equipment.

A powerful spring action, dead front safety shutter confines arcing and keeps out dangerous foreign particles such as dust, metal filings, and lint.

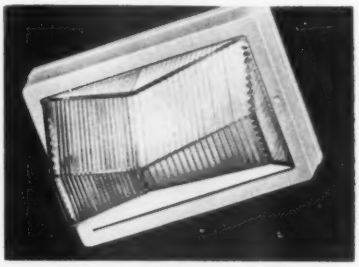
Write P-120 on reply card, pg. 17



Outdoor wall light fixtures utilize prisms for diffusion

THE PERFECLITE CO., 1457 East 40th Street, Cleveland, Ohio, recently introduced a completely new exterior wall fixture specifically designed for entryways, walkways and loading areas.

Called the Pharos, this ultra-modern unit gives an asymmetric light pattern providing good illumination for wall areas, and at the same time throws a powerful outward distribution of light 90° from the wall. The heat resistant glass refractor uses accurately calculated prisms on six transmission surfaces and incorporates a silvered glass reflector on the top surface which directs the light downward into useful areas. The modular shape of this new fixture completely outmodes the standard arm style exterior bracket extending on a heavy arm from the wall.



It has been approved by Underwriters' Laboratories, Inc.

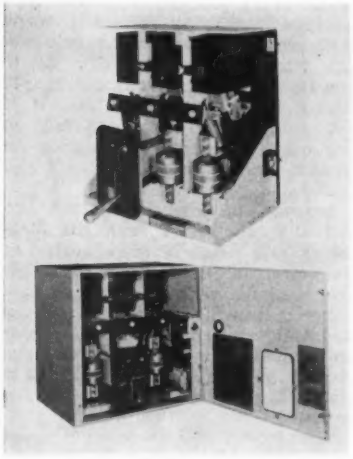
Write P-121 on reply card, pg. 17

Coordinated fuse-breaker unit offers low-cost protection

THE FUSEMATIC, a new 600 volt 200,000 ampere coordinated fuse-breaker unit, offering fault circuit protection at a substantially lower cost than if a conventional breaker alone were used, is now being introduced by Federal Pacific Electric Co., General Offices, 50 Paris St., Newark 1, N. J.

An integral unit combining components of conventional low-voltage power circuit breakers and current-limiting fuses, Fusematic is rated up to 1,600 amperes continuous and 200,000 amperes interrupting capacity. Its primary application is for service entrance and feeder protection where high fault current exists.

In this application it offers faster



interruption as well as better protection, since the current limiting fuses actually reduce possible fault current.

Fusematic also has the advantage of being only 24" wide and 22½" high. In addition, Fusematic uses standard fuses that are commercially available. Single phase protection is achieved by the potential difference appearing across the terminals of the blown fuse, rather than by a striker pin fuse.

Write P-122 on reply card, pg. 17

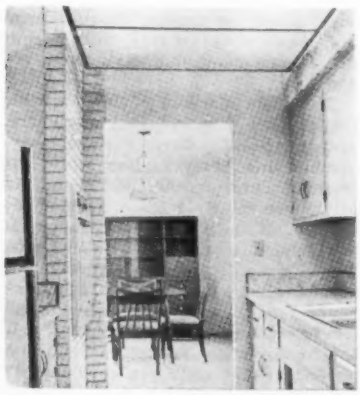
Louvered grill-work ceiling scores in kitchen lighting

THE PROBLEM of arranging lighting fixtures in bathrooms or kitchens has been solved by the Sta-Brite Fluorescent Mfg. Co., 3550 N. W. 49th St., Miami 42, Fla. The answer is a complete louvered luminous ceiling called Modernlite.

The new ceiling comes in 24-square-foot sections. It is available in a variety of colors, and is trimmed in natural or gold anodized aluminum.

The pre-fabricated units can be assembled, installed, and connected to existing ceiling outlets in 15 minutes, according to the manufacturer. They are easily dismantled and cleaned by dipping the Sta-Plex grille-work in a detergent bath.

Write P-123 on reply card, pg. 17



Aluminum lamp holders have built-in splice chambers

A NEW, handy, easy-to-install line of PAR-38 and R-40 lamp holders have been added to the lighting line manufactured by the Killark Electric Mfg. Co., Vandeventer and Easton Aves., St. Louis, Mo.

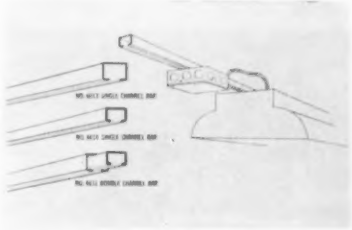
They are made of die cast aluminum and each has its own built-in splice chamber, designed for easy accessibility.

Write P-124 on reply card, pg. 17

Electrogalvanized steel channels come in duo-sizes for more uses

STEEL CITY ELECTRIC Co., 1207 Columbus Ave., Pittsburg 33, Pa., has a new addition to the line of electrogalvanized steel channels available to the electrical trade for the support of electrical equipment. This is the all purpose Channel Bar.

The new channel is especially suited to suspended ceiling construction,



and comes in two sizes designed for maximum utility used separately or one inside the other. The larger size is .388-inches deep with an inside width of .576-inches; the smaller channel has a depth of .263-inches and an inside width of .451-inches. The channels are also available as a double bar assembly with the smaller channel inside the larger. Both

Latrobe PRODUCTS

★ FLOOR BOXES ★ WIRING SPECIALTIES ★

"Tru-Level" Floor Box

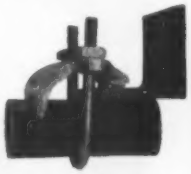
For quick, on-the-job installation, you can't beat the #190 "Tru-Level" fully adjustable steel floor box. Quick and easy tru-leveling is accomplished by an adjusting-ring threaded ½" and three 2½" long screw legs. Nine K O's take care of any size wiring and large opening enables inside attachment of conduit without removing box body cover.

Listed under re-examination service Underwriters Laboratories, Inc.

Insulator Supports

Fastens to steel framework without punching holes. 4 sizes —1", 1½", 2" and 2½".

"Latrobe" Pipe or Conduit Clamp



This clamp is made of malleable iron, cadmium plated to prevent rust and has a safety bite of case hardened tool steel.

Two models—right angle and parallel—each in 11 sizes to handle pipe or conduit ⅜" thru 4".

LATROBE PRODUCTS

NON-ADJUSTABLE FLOOR BOXES—ADJUSTABLE FLOOR BOXES—GANG BOXES—COVER PLATES—JUNCTION BOXES—NOZZLES—PIPE OR CONDUIT HANGERS—INSULATION SUPPORT—CABLE SUPPORTS—FISH WIRE STAPLE AND CABLE CLIPS

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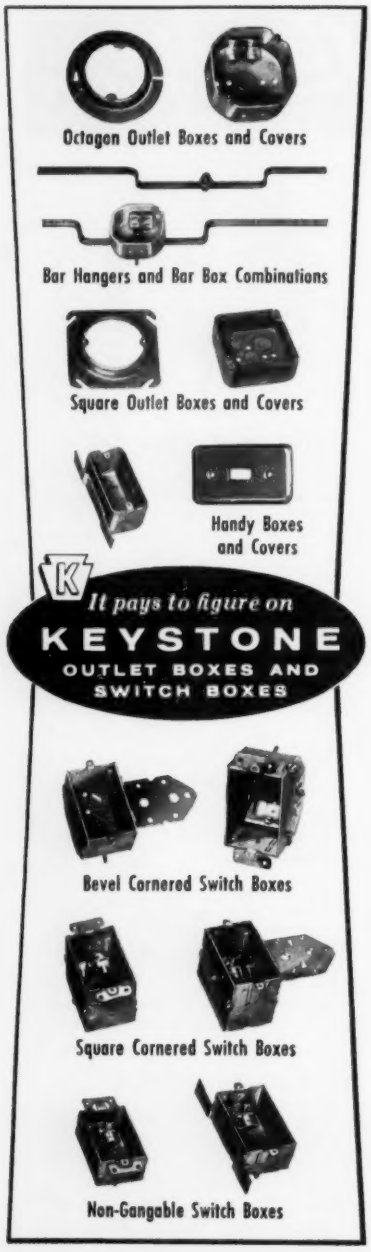

Octagon Outlet Boxes and Covers
Bar Hangers and Bar Box Combinations
Square Outlet Boxes and Covers
Handy Boxes and Covers
It pays to figure on
KEYSTONE
OUTLET BOXES AND SWITCH BOXES
Bevel Cornered Switch Boxes
Square Cornered Switch Boxes
Non-Gangable Switch Boxes

Keystone Outlet Boxes and Switch Boxes are loaded with extras! BX and Romex clamps are pre-assembled for easy pulling of wires, knockouts come out *fast*, and tapped holes are extruded to eliminate stripping of threads.

What's more, they come in all sizes, shapes and types—and they're stocked at regional warehouses coast-to-coast, for immediate delivery—*wherever you are!*

3 NEW CATALOGS—contain complete information on the entire Keystone Quality line of wiring installation equipment. Send for your free set today!

KEYSTONE MFG. CO.
23378 Sherwood Rd. • Warren, Mich.

channels have a continuous slot opening of .281-inches.

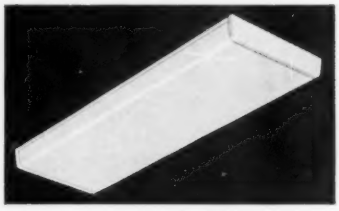
In conventional applications the all-purpose channel bar is supported on runs of the ceiling-carrying channel system or directly from bar joist or ceiling beams. It is installed slot side down and positioned according to electrical layout requirements.

Write P-125 on reply card, pg. 17

Four-lamp economy unit fits many arrangements

THE WAKEFIELD CO., Vermilion, O., announces production of its 4 ft. "Prismatic-100" four 40W-RS lamp economy unit, applicable almost anywhere singly or in rows.

This companion to the two-lamp "Prismatic-50" will also be distributed and stocked nationally by Graybar Electric. White ceilings and light walls recommended for better vision and to get the light you pay for. For 100 footcandles install one unit for each 40 sq. ft. of area.

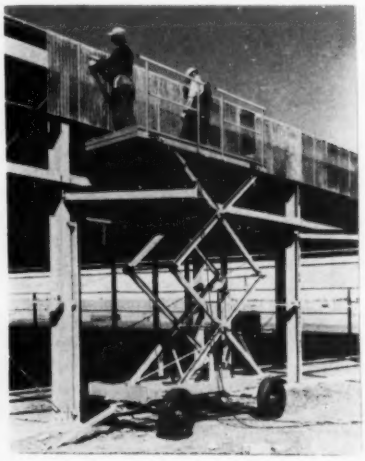


Clear panoramic plastic lens and steel parts white enameled are two features of the new lamp unit.

Write P-126 on reply card, pg. 17

Elevating scaffold and lift form portable platform unit

THE NEW Sky Witch, a portable materials lift and hydraulically elevating scaffold, is now available in a variety of sizes and capacities to fit every job requiring this type equipment. The Sky Witch is made with standard platforms ranging in size from 2½' x 7½' to 5' x 24' to elevate to heights from 10' to 24', lifting loads up to one ton. It is available or skids for mounting on the user's conveyance, mounted on casters, pneumatic-tired wheels and trailers.



Raising and lowering of the Sky Witch is controlled from the platforms by a single lever regardless of the power unit used. Standard models are available with a choice of gasoline or electric motors to power the hydraulic system. Optional power units include air motors which have proved popular in chemical plants and other areas where hazardous vapors are likely to be present.

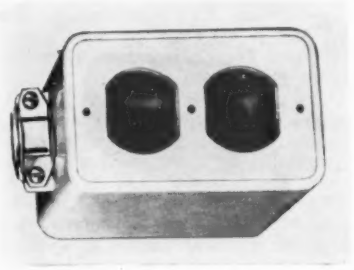
The Sky Witch is manufactured by the Charles Machine Works Inc., 699 B Street, Perry, Oklahoma.

Write P-127 on reply card, pg. 17

Portable outlet box brings power to job in safer form

A NEW SERIES #3000 portable outlet box, designed to enable the user to bring safe power to the job, has been introduced by the Daniel Woodhead Co., 15 North Jefferson St., Chicago, Ill., manufacturers of "Safety Yellow" electrical products.

This new "Safety Yellow" Neotex rubber portable outlet box permits the maximum amount of flexibility because it's designed to fit all standard 2 or 3-wire, 10 amp., 15 amp., or 20 amp. receptacles. Any standard shelf stock receptacles in these ratings, single or duplex, fit into front and back cover plates, and permit use of any combination of these receptacles.



The new Series #3000 Portable Outlet Box may be used anywhere, and is especially fitted for use in assembly lines, construction work, industrial plants, movie and TV studios, anywhere multiple outlets are needed, including home work shops. It is electrically and mechanically safe. The Neotex rubber construction is said to protect finished surfaces, exposed machinery and is safe around live electrical contacts. "Safety Yellow" color gives maximum visibility.

Write P-128 on reply card, pg. 17

Easy-heat electric floor extends hog farrowing time

A FAST, NEW, low-cost method of installing electric heat in the concrete floor of hog farrowing and fattening pens, to prevent piglets from freezing in severe winter weather, has been introduced by Easy-Heat, Inc., Lakeville, Ind., manufacturer of electric anti-freeze devices.

Designated as the Easy-Heat electric floor heater, with patents applied for, the new packaged electrical product incorporates prespaced

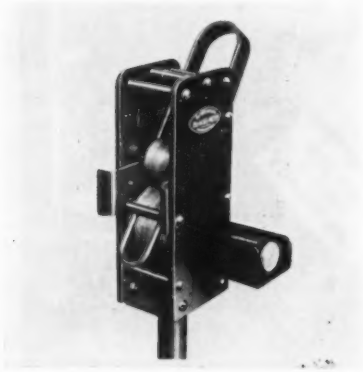
thermoplastic insulated resistance wire which is anchored in place in galvanized steel mesh mats 6' long and 18" wide. Non-heating lead wires and ground lead are also attached to further simplify installation.

A safe heat of 42 watts per square foot is dissipated on 230 voltage. Since the preassembled units may simply be rolled into place by an electrical contractor, considerable installation time is saved. Wire mesh also protects the heater wire and adds extra reinforcement to the concrete. There is no danger of wires "floating" together to cause "burn-outs" as concrete is poured.

Write P-129 on reply card, pg. 17

Up to 1,000 feet measured quickly by cable meter

EASY and accurate measuring of heavy, large-size cable now can be achieved with the improved cable meter by HyKon Manufacturing Co., 135 East State St., Alliance, Ohio.



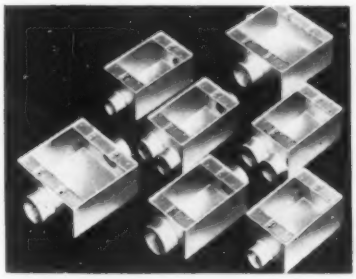
The Model HCM has a direct-drive Veeder-Root counter, calibrated in feet and inches for better reading accuracy. The meter measures up to 1000 feet and has instant zero-reset. Proper spring tension is maintained on the measured material to prevent slippage and "shrinkage", with a convenient release handle to permit free insertion and removal of the cable.

Added features of the Hykon HCM include: a swivel wire guide adapter built in for measuring small wire sizes and a floor-type meter stand adjustable from 30" to 48" in height.

Write P-130 on reply card, pg. 17

More space in conduit boxes makes installation easier

NEWLY DESIGNED types of Red Dot one and two gang conduit boxes have been introduced to the market by the L. E. Mason Co., Boston 36, Mass.



Both are type "FS" boxes, made of high pressure cast aluminum, with threaded bodies for heavy wall rigid conduit. Special clearance holes in the new design solve the usual problem of cross threading of the switch box cover's screws. Additional clearance space also allows for retaining washers inside the box.

Recessed surface plates inside the conduit boxes insure that the device-strap mounting will have flush and unrestricted pressure on the gasket. The boxes also feature a flat ground seating surface.

Designed with adaptability in mind, both the one gang "FS" and the two gang "FS" Red Dot boxes come in a wide choice of mounting screw holes for all covers.

Write P-131 on reply card, pg. 17

Correction capacitors work in above-normal heat range

A NEW SERIES of 20 KVAR power factor correction capacitors for low-voltage industrial applications has been announced by the Industrial Capacitor Department of the Sprague Electric Company, 311 Marshall Street, North Adams, Mass.

Known as the Sprague Type PF standard and PFD dustproof series,

ELECTRIC HOT WATER HEAT TO 2,000,000 B.T.U.

PRECISION

ELECTRIC HOT WATER HEATING BOILER

COMPLETE UNIT READY FOR INSTALLATION with circulating hot water system and water chiller for year-round air-conditioning

CONVERSION EASILY ACCOMPLISHED where other type fuels now used. Suited for homes, churches, motels, apartments, hotels, hospitals, commercial buildings, swimming pools, snow melting and domestic hot water. Temperature Range 60 to 250 degrees.

Every unit tested and inspected.

- 40,948 B.T.U. to 2,000,000 B.T.U. Output.
- All Boilers meet the requirements of the ASME Boiler and Pressure Vessel Code.

No flame!
No ducts!
No noise!
No chimney!
No odors!

Write for specifications and prices.

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JIC and NEMA 12

OIL-TIGHT
DUST-TIGHT

ELECTRICAL ENCLOSURES

WALL MOUNTED, in 18 stock sizes.

FLOOR MOUNTED, in double door or multiple door units—11 stock sizes.

JIC NEMA 12 PANEL ENCLOSURES

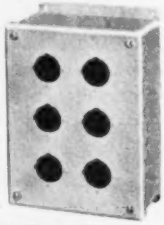
Ideal for housing electrical controls, components and terminal strips. Note removable mounting panel. Neoprene gasket on door protects against dust, dirt, oil, water. Strong welded construction. No holes or open seams. Also available in NEMA types 1, 3, 4 and 5.

JIC WIRING BOX

Heavy gauge steel, welded seams. No knockouts or holes to leak oil, water or dust. Neoprene gasketed cover with screw clamp makes tight oil-proof seal. Available with or without removable panel. 8 stock sizes from 4"x4"x3" to 16"x14"x6".

PUSHBUTTON ENCLOSURES

A complete selection of types and sizes. Fine quality construction and finish. Welded seams. Cover has neoprene gasket. Holes take any standard oil-tight pushbutton. Types range from "Standard" *as shown*, to Extra Deep, Slim and Pendent. For one to 25 pushbuttons.



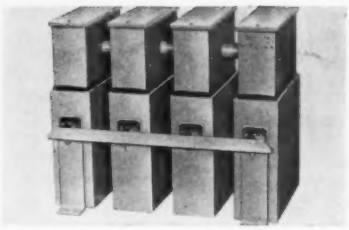
OIL-TIGHT JIC SECTIONAL WIREWAY

Perfect protection for control wiring. Neoprene gasket on cover and between joints seals out liquids and dust. Easy to assemble. Full length hinged cover simplifies wiring installation or modification after installation. Stock sizes: 2½"x2½", 4"x4" and 6"x6" in lengths up to 10' with Elbows, "T"s, etc.

We also build enclosures to customer specifications

Hoffman ENGINEERING CORPORATION

Dept. ES-121 Anoka • Minn.



the new capacitors are furnished for both single and three-phase applications at 480 and 600 volts, 60 cy.

All capacitors are impregnated with Clorinol, a non-flammable askarel synthetic liquid dielectric to permit operation over the temperature range from —40°C to +46°C (—40°F to +115°F). A special feature of the Type PFD dustproof series of capacitors is the incorporation of current-limiting fuses as standard equipment with the capacitor. These fuses will interrupt 100,000 amperes and are equipped with convenient set screw connectors capable of handling No. 3 wire or smaller.

A complete series of single, dual, triple, and quadruple brackets for floor, wall, or ceiling mounting is also available.

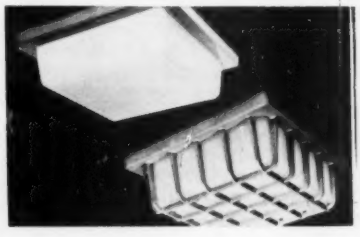
Write P-132 on reply card, pg. 17

Surface-mounted lighting fits areas indoors or out

THE 43-88 LIGHTING line, an all-new surface-mounted series by McPhilben Lighting, Inc., 1329 Willougby Ave., Brooklyn 37, N. Y. is designed for everything from lighting shower rooms, vestibules, and lobbies, to covered walkways, industrial areas, loading platforms, and swimming pools. It is also suited for lighting under canopies and marques.

This series features cast aluminum construction throughout, with satin-anodized finish for permanence against corrosive elements indoors and out-of-doors. Impact-resisting, square-shaped, moulded carrara glass diffuser (⅜" minimum wall thickness) is gasketed in a hinged trim for easy relamping and maintenance. Supplied complete with 4-inch, cast aluminum junction box, gasket and screws for vaportight seal at conduit entry.

Write P-133 on reply card, pg. 17



Patent Number 2885169

Universal

THIEL'S HUMP "NAIL-IT"

For fasteners that hold. This THIEL hump drive NAIL - IT strap has a sturdy head to insure an easy drive without bending . . . will not pull out. Zinc plating prevents rust. . . . made of #8 heavy wire. Available in copper plating for plumbers use.

Sold by Leading Electrical Wholesalers

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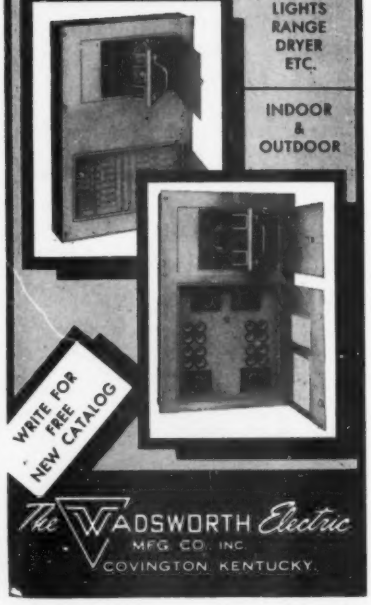
FUSIBLE OR CIRCUIT BREAKERS
CONTROLS FOR WATER HEATER
AIR CONDITIONERS — HEATING PANELS



LIGHTS
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INDOOR & OUTDOOR

WRITE FOR FREE NEW CATALOG

The WADSWORTH Electric MFG. CO. INC.
COVINGTON, KENTUCKY.

Helpful literature

available to our readers

A handy method of calculating a power system's increase in revenue with **feeder voltage regulation** has been published by **General Electric Co.,** Schenectady 5, N. Y. The four-page leaflet, GET-3023, gives a formula for finding the annual revenue increase in dollars for a feeder of any size, load factor, and percent of voltage-sensitive load when the voltage is raised from any lower, unregulated value to 100% of system rating.

Write B-134 on reply card, pg. 17

Sun-Tron Corp., 7435 West Wilson Avenue, Chicago 31, Ill., is offering a new catalog describing the company's new line of decorator-styled **electric heating units** for the home. In four colors, the eight-page catalog pictures the units and the various plastic laminate finishes available, cites size and specifications for each model, and offers general information on the Sun-Tron heating system.

Write B-135 on reply card, pg. 17

Hubbard Aluminum Products Co., 200 S. Michigan Ave., Chicago 4, Ill., announces the availability of a new 32-page two-color catalog on their HAPCO line of **aluminum alloy lighting standards.** Detailed descriptions, dimensions and illustrations are furnished on lighting standards with various bracket styles; flood lighting standards; lamp posts and traffic poles.

Write B-136 on relpy card, pg. 17

A revised, enlarged edition of its popular **"Masonry Anchoring Handbook"** has been issued by **The Rawlplug Company, Inc.,** 244 Petersville Road, New Rochelle, N. Y. The 48-page, pocket size publication has been prepared especially for architects, engineers and users of masonry anchors and drills.

Write B-137 on reply card, pg. 17

Six important safety features of new **Type L combination safety starters** are discussed in new booklet B-7322, entitled "Industry's Safest Line of Combination Starters," and published by **Westinghouse Electric Corp.,** P. O. Box 2099, Pittsburgh 30, Pa., designed to meet recommendations of the Joint Industries Council, are used to control industrial equipment such as heavy machine tools.

Write B-138 on reply card, pg. 17

A new 20-page catalog showing the enlarged Markstone line of **recessed** and **accent lighting fixtures** for residential and commercial applications has been issued by **Markstone Manufacturing Co.,** Chicago. Attractively printed in color, the new catalog illustrates and describes the wide range of styles and sizes now available in Markstone's "Lumi-Dome" Recessed Boxes, "Hi-Hat" Round Recessed, and "Eyeball" fixtures.

Write B-139 on reply card, pg. 17

Emerson Electric Mfg. Co., 8100 Florissant Avenue, St. Louis 36, Mo., presents its new 1960, four-color, 52 page catalog, showing more than 184 true color photos of the new Emerson-Imperial **surface mounted lighting fixtures** designed for every room in the home.

Write B-140 on reply card, pg. 17

Publication of a 44-page booklet, PSG 559, on **secondary unit substations** has been announced by **Pennsylvania Transformer Division, McGraw-Edison Co.,** Box 330 Canonsburg, Pa. The booklet contains descriptions of the company's substation line (articulated and integrated, indoor and outdoor), definitions, and general application data. All major components are shown and described in detail.

Write B-141 on reply card, pg. 17

The **Frank Adam Electric Co.,** Main P. O. Box 357, St. Louis 66, Mo., manufacturer of electrical distribution equipment, has announced the completion of a new catalog covering their complete line of light, standard and heavy duty **safety switches.** The catalog contains all information necessary for specifying and ordering safety switches, including dimensions, capacities, voltages and horsepower ratings.

Write B-142 on reply card, pg. 17

Power-installed screw anchors are the subject of a new 12-page booklet titled "Mechanizing Anchor Installations." It describes how utilities power hole-boring equipment can be adapted to easily install this new line of anchors. Photos show installation procedures. Installation time, torque and holding-power test data is included. Write for Bulletin 868, **A. B. Chance Co.,** 210 North Allen Street, Centralia, Mo.

Write B-143 on reply card, pg. 17

Booklet A-6832 describing a lamp **relamping plan** for users of large quantities of fluorescent lamps, is now available from the **Westinghouse Electric Corp.,** Lamp Division, Box 388, Bloomfield, N. J. Entitled "Group Relamping Plan," the book-

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let points out how time and money can be saved. Sample calculations help the user calculate his own relamping schedule.

Write B-144 on reply card, pg. 17

Just off the press, a new 16-page catalog devoted exclusively to Bell deluxe **weatherproof wiring devices,** covers, and boxes is offered by **Bell Electric Co.,** 5735 S. Claremont Ave., Chicago 36, Ill. Modern, easy-to-read format, handsomely printed in color, makes all information easy to find.

Write B-145 on reply card, pg. 17

How to insulate homes and buildings to get the full benefits of electric heating is the subject of an informative new brochure just published by **Baldwin-Ehret-Hill, Inc.,** 500 Breunig Ave., Trenton, N. J., manufacturers of spun mineral wool insulations for home and industry. The profusely illustrated, six-page, two color publication gives the advantages of a correctly insulated, electrically heated home.

Write B-146 on reply card, pg. 17

Bulletin 3-450, an eight-page catalog describing new **higher-rated DST air circuit breakers** of **Federal Pacific Electric Co.,** 50 Paris St., Newark 1, N. J., types DST 5-350 and DST 15-1000 for use in metal-clad switchgear has been issued by the company. For each of these two new types of DST Air Circuit Breakers, which are rated at 5 kv 350 mva and 15 kv 1000 mva respectively, complete information is given on applications, construction details and features, and breaker and cell design.

Write B-147 on reply card, pg. 17

Available at no charge from the **Remcon Division** of the Pyramid Instrument Corp., 630 Merrick Road, Lynbrook, N. Y., is their new **Electrician's Manual,** RM-610. This manual is considered the most up-to-date piece of information on low-voltage switching.

Write B-148 on reply card, pg. 17

The **Thomas & Betts Co., Inc.,** 72 Butler Street, Elizabeth 1, New Jersey makes available catalog D59, including new **compression connectors and installing tools** recently developed. The tools are for use at usual distribution voltages and for "hot line" applications.

Write B-149 on reply card, pg. 17

Bulletin GEA-6126B, 24 pages published by **General Electric Co.,** Schenectady 5, N. Y., gives complete information on the construction features and operation of self-protected **distribution transformers** rated 100 kva and below.

Write B-150 on reply card, pg. 17

Pad-mount transformers for underground distribution systems are described in bulletin DT8, published by **Line Material Industries,** McGraw-Edison Co., Milwaukee 1, Wis. This new publication covers design and operating features, as well as application and ordering information.

Write B-151 on reply card, pg. 17

Code discussion

(Continued from page 74)

ing now that although branch circuit conductors, if approved for the tempe ..ture, may be run to fixtures, fixture wire *cannot* be used for branch circuit conductors. (Branch circuit conductors are usually run to 60C fixtures directly to a junction provided with the fixture. For 90C fixtures, the branch circuit conductors are run to a junction installed by the electrician at least one foot away and connected by from four to six feet of high-temperature wire).

Additional Code changes will be discussed in the February issue of this magazine.

Answers to Code test questions: (1. **T** Section 300-19) (2. **T** Note 8, Table 310-12) (3. **F** Sections 320-1

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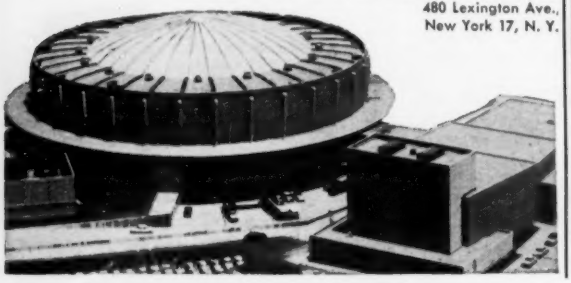

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and 320-2) (4. **F.** Section 324-5) (5. **T** Section 324-2-a) (6. **c** Section 336-6-b) (7. **a** Section 338-3-a-b and note) (8. **b** Section 351-2) (9. **c** Section 352-4) (10. **c** Sections 402-2 and 410-18).

Hot profit item

(Continued from page 33)

alter our labor figure for the job.

Every detail figured

"With competition you've got to figure every little detail. If the gas boys are permitted to capture this business, they'll snag the lion's share of the domestic appliance business and thus short circuit the services of the electrical contractor."

When his carefully-compiled estimate receives a negative nod from a builder, Bowlby retorts: "We've got our overhead. We're not Johnny-come-latelys working out of a garage. Have you ever had a buyer of one of your homes complain to you about our work? You know you can always find us."

Bowlby's invariable practice is to inform homebuyers to call him and not the builder in the event of trouble with the heating installation. That builders are grateful for this consideration is evidenced in the remark of one builder: "Bowlby, I know I can beat your price. But I can't beat your quality, and I'm dead sure I won't have any of my buyers on my neck."

To which Bowlby answers: "Well, if you think we're too high for you on this job, maybe it'll be all right on your next job."

In some cases this mild selling has landed the job, anyhow.

Latest statistics report 20 million existing homes across the nation having sub-standard wiring. The electrical industry envisions all-electric homes in which electricity will take the place of other fuels. Bowlby feels that such a home would require a 200 amp service with at least six 240-volt circuits of 30-amp capacity to serve the major appliances.

The average home today uses about 3,300 kwh per year, while an average total electric house will use between 25,000 and 30,000 kwh annually. How Southern electrical contractors may fare in digging up electric heat business may be seen in Tampa Electric's 1958 report which showed that the utility's residential customers used an average of 4,675 kilowatt hours, a 15 per cent increase over

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the company's 1957 average.

Certainly aggressive selling of heating systems by contractors like Bowlby is responsible for the boost in current consumption for electric heat. Bowlby emphasizes, "There's no substitute for quality. There is no getting around this basic principle, and we feel our success against major competition has been because of our interest in our customers and in giving them a good job. We know that to keep a builder, architect, or individual home owner as a customer is far better than trying to get new ones. While both are necessary in this expanding business if we aren't to be swamped by the natural gas competition, we feel that it is even more necessary and profitable to keep our old customers than to spend all our effort toward getting new ones constantly."

Modular panel board

(Continued from page 31)

and enclosures by catalog numbers.

On the basis of this information, it was decided that Supreme Sugar would need a 600 ampere panelboard (72" x 8¾" x 28¾") which would accommodate 12 F Frame breakers.

The next step was to get the equipment. To do this, we only had to drive to New Orleans. At the warehouse of an electrical distributor (Interstate Electric) who had been alerted by the Federal Pacific representative, we picked out of stock the right assortment, the particular enclosure needed, and the proper assortment of breakers.

While the panelboard was being obtained, men at the refinery were readying the installation so it could receive the new panel. By the time the equipment had arrived, the wires were in position and stubbed up. Now all that had to be done was put in the enclosure, tie in the feeder to the enclosure bus, then stab-in nine individual new breakers, connect the branch conductors, and finally cover the unused section of the bus with molded filter plates in order to secure a dead front.

Incredible as it seemed, less than ten hours from the time the original panelboard had burned out Supreme was sacking sugar again, and all because the company had made it a point to keep abreast of new developments!

Apprentice program

(Continued from page 30)

tractors pay and who will help Americans to continue to increase their living standard.

"This is one reason why our committee decided to start training boys in electronics. We are even giving apprentice graduates a chance to return to night school to study electronics."

The committee has been awarded a Certificate of Meritorious Service that bears the signature of Secretary of Labor James P. Mitchell. This certificate recognizes the committee's service to our country.

Washington report

(Continued from page 14)

ployee's services may reasonably be expected to continue for more than one year in any particular project area. . ."

Whether the payments are deductible for income tax purposes is not determined by the employer's withholding of the tax. It appears to be up to the employee to determine that matter with the tax collector.

The new ruling applies only to income taxes. It became effective Jan. 1, 1960.

Capacitor seminar

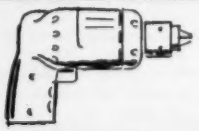
(Continued from page 63)

of electrical bus and cable connections as well. Examples of the more complex capacitor rack equipments incorporating the design considerations discussed in this paper are shown in the picture section.

"The increased benefits to the utility through the use of welded aluminum rack equipment is the result of one of the many steps which manufacturers continue to take in search of better and more economical power capacitor equipment. We must constantly review and revise our manufacturing techniques, search for new improved materials and designs and take better advantage of the existing material to provide the utility with more efficient low-cost capacitor equipment to meet the ever-increasing demands for system betterment."

Secondary capacitors

An economic study of secondary capacitors was presented by H. G. Saddock, of Rochester Gas and Electric Corp. He approached the problem of justifying secondary capacitors from several different angles. Considering the secondary capacitor from a loss reduction viewpoint, he concluded that such capacitors showed negligible savings on 90% p.f. secondaries up to



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50c per year on 80% p.f. secondaries with two kvar. His study indicated that in both cases the first unit is the most beneficial so that small size secondary capacitors scattered uniformly over the system would be the ideal economic solution from the loss reduction viewpoint.

An analysis of the economics of secondary capacitors from a released capacity point of view resulted in an annual saving of $3.30 per kva. A third analysis studied the economics of secondary capacitors from a viewpoint of voltage revenue gain. This study showed that the peak dollars per kvar of secondary capacitors exist at very light density of them. For example, a one kvar unit will save 80c/kvar while four kvar represents a saving of only 35c/kvar.

Series units discussed

Two papers were presented at the closing session on series capacitors. D. C. Keezer, of Pacific Gas and Electric Co., discussed his company's experience with 12 kv series capacitors. An interesting point in this paper was the experience with resonant conditions that lead to the use of damping resistors as standard components for all series capacitors.

The second paper on series capacitors was presented by Fred C. Crowell, Public Service Company of Oklahoma, who described his company's operating experience with secondary capacitors in series with distribution transformers. Such units are used to improve the voltage level on the secondary of a transformer and to lessen or eliminate any voltage flicker which might be present.

He reported that there had been no voltage problems as a result of this use of secondary capacitors and that no damage to customer equipment has been reported. Flicker complaints caused by series capacitors have numbered less than a dozen during five years that capacitors have been used in this manner. Only five service interruptions have been caused by the failure of series capacitors.

He reported that there have been no serious operating problems and that the benefits obtained by the use of capacitors in series with distribution transformers outweigh by far the difficulties experienced.

Contractors tell how

(Continued from page 36)

accounting methods that his money is held up while he is getting straightened out.

These types of general contractors usually get behind schedule and in turn force the sub-contractors to absorb penalties and damages. Associating with them hurts an electrical contractor in many more ways than one. The electrical contractor short of capital could well be put out of business waiting to receive payment.

The general contractor with a well-run office and efficient accounting methods knows the ropes in government work, steers clear of difficulty, and usually gets his money within a reasonable time. The electrical contractor working with him suffers no lengthy delay in collecting. Moreover, by association with him, an electrical contractor's good reputation is enhanced with local authorities.

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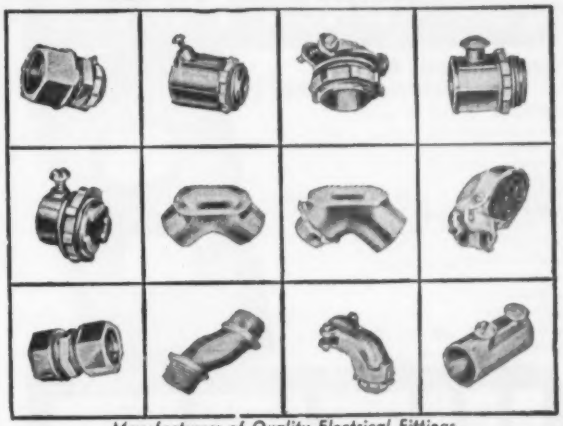

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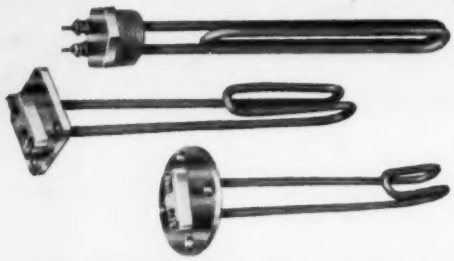

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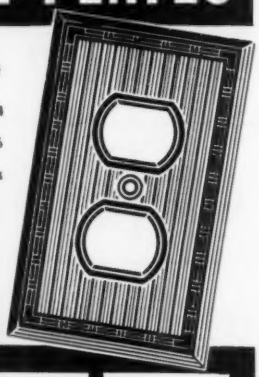

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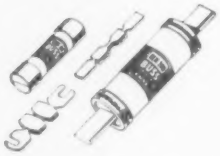

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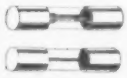

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